MAY 25 1925
PERIODICAL ROOM GENERAL LIBRARY UNIV. OF MICH.

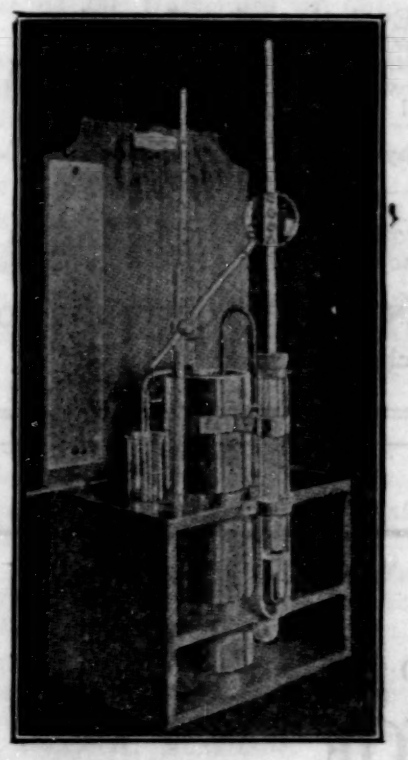
SCIENCE

NEW SERIES
VOL. LXI, No. 1586

FRIDAY, MAY 22, 1925

ANNUAL SUBSCRIPTION, $6.00
SINGLE COPIES, 15 CTS.

APPARATUS FOR FREEZING POINT DETERMINATIONS



HORTVET CRYOSCOPE

Recommended for molecular weight work as it is convenient to operate; tests can be made very quickly, accurately and at little expense.

Freezing point determinations can be made over practically the entire range. For temperatures just below the freezing point of water, for example, for milk and similar products, ether is ordinarily used as refrigerant; for lower temperatures, use liquid air.

The HORTVET CRYOSCOPE has been adopted by the Association of Official Agricultural Chemists, also by the American Public Health Association, as the official instrument for determining added water in milk.

A new and important use is the determination of added water in cream, both qualitatively and quantitatively. In testing oils and similar products, the oil is frozen and then the melting point determined in the regular way.

For details in regard to the testing of milk, write for bulletin No. 284.

For the use of the HORTVET CRYOSCOPE in molecular weight work and general freezing point determinations, write for bulletin No. 316.

EIMER & AMEND

Established 1851, Incorporated 1897

Headquarters for LABORATORY APPARATUS and CHEMICAL REAGENTS

Third Ave., 18th to 19th St. **NEW YORK, N. Y.**

Pittsburgh, Pa., Agent, 4048 Franklin Rd., N. S.

From the UNIVERSITY
OF CALIFORNIA PRESS

LAWSON	The Cypress Plain *25 cents*
MILLER, LOYE	Avifauna of the McKittrick Pleistocene *25 cents*
HANNA	Genus Venericardia from Eocene of West Coast of North America *45 cents*

New List of Publications free upon request

University of California Press
Berkeley, California

Patents, Invention and Method

By H. D. Potts

A Guide to the General Lines of Procedure in Invention and Discovery

A collection of essays by a Chartered Patent Agent who is a University man of reputation. The following three important problems are dealt with in considerable detail:

(a) The Criterion of an Invention.
Is it possible to fix an objective by which we can decide whether a given industrial improvement is an invention or not? Where does constructive skill end, and where does inventive ingenuity begin?

(b) The Definition of an Invention.
Inventions are protected by legal documents termed specifications. What is the theory of a definition of invention by means of language? What is the best method of definition in practice?

(c) The Evolution of an Invention.
Is it possible to formulate a technique of invention or discovery? Is there any method of attack which is of general value in dealing with specific industrial difficulties?

For sale by all bookstores, or sent direct upon receipt of $1.00 (paper).

Send for complete catalogue of Books on Sciences, Philosophies and the History of Religion.

THE OPEN COURT PUBLISHING COMPANY
122 S. Michigan Ave. Chicago

JUST PUBLISHED

A MANUAL OF DESCRIPTIVE SYSTEMATIC BOTANY

By A. S. HITCHCOCK, B.S., M.S., D.S.

Botanist in Charge of Systematic Agrostology, United States Department of Agriculture, formerly Professor of Botany at Kansas State Agricultural College.

This book is a response to the great need for a systematic botany which treats of taxonomy from the standpoint of technique.

The first six chapters deal with the elements of descriptive taxonomy; the remainder of the work treats of the subject from the standpoint of advanced students or those beginning their professional careers as assistants in botanical institutions. Along with the strictly taxonomic development of the subject there have been included chapters or paragraphs dealing with more or less related subjects which it was thought might be helpful.

16 pages. 6 by 9. *Ready During June.*

JOHN WILEY & SONS, Inc.

440 FOURTH AVENUE NEW YORK

SCIENCE

VOL. LXI MAY 22, 1925 No. 1586

CONTENTS

The Relationship of Human Constitution to Disease: DR. GEORGE DRAPER 525

The Differentials Effective in the Distribution of Plants in the Coastal Plain: PROFESSOR JOHN W. HARSHBERGER 529

Burt Green Wilder: PROFESSOR J. H. COMSTOCK 531

Scientific Events:
Clément Ader and the Aeroplane; Captain Amundsen's Proposed Flight to the North Pole; The British Science Guild; Unpublished Preparations for "Organic Syntheses"; The School of Medicine of the University of Chicago; Award of the Thompson Gold Medal of the National Academy of Sciences; The First Award of the Leidy Memorial Medal; The American Philosophical Society 533

Scientific Notes and News 536

University and Educational Notes 539

Discussion and Correspondence:
The Kennelly-Heaviside Layer: PROFESSOR ALEXANDER MCADIE. *Musical Echoes:* DR. MACFIE CAMPBELL. *A Historic Fossil:* DR. G. R. WIELAND. *A Philippine Rorqual:* ALBERT HERRE. *Legislation on the Teaching of Evolution:* DR. BERT CUNNINGHAM 540

Scientific Books:
Castle on Genetics and Eugenics: PROFESSOR CHAS. B. DAVENPORT 541

Segregation of Carbohydrates in Maize Pollen: DR. A. E. LONGLEY 542

Scientific Apparatus and Laboratory Methods:
The Use of Bakelite in the Preservation of Fossil Material: PROFESSOR E. C. CASE 543

Special Articles:
The Inoculation of Tomato and Tobacco Plants with Potato Mosaic Virus: DR. PETER K. OLITSKY AND DR. JOHN H. NORTHROP. *The Topography of the Golgi Apparatus in Gland Cells:* PROFESSOR ROBERT H. BOWEN 544

The National Academy of Sciences:
Abstracts of Papers presented at the Washington Meeting 546

Science News x

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

New York City: Grand Central Terminal.

Annual Subscription, $6.00. Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 3, 1879.

THE RELATIONSHIP OF HUMAN CONSTITUTION TO DISEASE[1]

THREE years ago at the meeting of this association in Boston I had the honor of reporting before the anthropological section the results of the attempts of our Constitution Clinic at the Presbyterian Hospital to apply the technique of anthropometry to clinical medicine. It is particularly gratifying now at the end of three years to discuss before the section on medicine the results of the work. Now because our first approach to the study of the subject was along the lines of anthropometry it must not be supposed that we have looked upon morphology as the main issue. This particular path was chosen simply because it offered at the moment the most obvious and practical entering wedge. It was indeed quite clear from the first that the subject of human constitution was sufficiently extensive and involved to occupy fully the efforts of many generations of workers; and as we have proceeded we have seen how true was Pope's famous line that the greatest study of mankind is man.

Viewed from this aspect disease ceases to be an entity in itself, a thing as it were added to or carried by man, and becomes rather the inevitable expression of conflict between unique individuality and an adverse specific environmental force. It is of course no new thought that the factor of susceptibility or predisposition to disease is of equal importance with the external specific agent. But perhaps it is just because of its antiquity that this factor has been overshadowed temporarily by the intensive studies which modern workers in medicine are directing at the lesion and the external agent.

The logical outcome of such a conception of disease is to turn an equally intensive research upon the factor of susceptibility. Obviously this must be a quality of the individual, an integral part of his constitutional plan. The successful investigation of this attribute consequently, as of any single character of plant or animal life is doubtless best furthered by a general and complete study of the whole organism. And so the thoughtful physician finds himself not primarily a student of disease, or menacing environment, but

[1] From the Department of Practice of Medicine, Columbia University and Presbyterian Hospital, New York City. Read before the American Association for the Advancement of Science, Section M, Medical Sciences, Washington, D. C., December 29, 1924.

rather of the natural history of man. The assumption of this attitude toward his patients was a common thing for the doctor of past generations in medicine. Indeed Martius has well said of Hippocrates that he was a doctor who thought like a naturalist. It is further interesting to observe that with the increasing definiteness of the science of genetics, the clinical investigators of to-day are turning back for light to the fundamental work of those great naturalists, Mendel, Weismann, Darwin and Galton.

Ordinarily when we think of constitution, it is as much a part of the individuality as any other attribute and can not be thought of except as a continuously personal property of the individual which is present from the moment of birth until death. But it is quite clear that the constitution must change with the different growth and development phenomena which take place in the life of the human organism. Now it is just at this point that the whole subject of constitution and the glands of internal secretion appear to be related. I do not believe that we are in a position to say at this time that the balance of the glands of internal secretion actually determines personality and constitution, but it is undoubtedly true that just as constitution varies in relation to the stage of the growth and development of the organism, so the glands of internal secretion are very largely concerned with this function in the life history of the individual. Any comprehensive study of the question of human constitution, therefore, must be more or less divided into five main epochs; the first, that which precedes puberty; the second, those years which include the puberty process; the third, that longer stretch of the active, vigorous, adult life; the fourth, the episode of climacteric; the fifth, the period subsequent to this. The organism obviously possesses a different arrangement of potentialities in each of these periods with which to meet the pressure of environment. Our studies so far have been limited to the adult or interpuberty climacteric phase. From this point of view all the studies that have been made on growth and development form definite contributions to the study of human constitution, and throughout the history of medicine there have appeared many attempts to evaluate this elusive quality of the individual. Formerly there was no very definite meaning for the word constitution; it implied rather a certain robustness or weakness of the individual. Obviously, there are a vast array of characters which together express the constitution of a man so that we have defined the term as follows:

Constitution is that aggregate of hereditarial characters, influenced more or less by environment, which determines the individual's reaction, successful or unsuccessful, to the stress of environment. In order to simplify the task of studying these many and varied elements, man's total personality has been divided into four main categories or panels. The use of the term "panel" in this connection arose from the conception of a Japanese screen composed of four panels across which was painted a complete picture. Any one of the panels alone would signify little, for upon it would be found but one phase of the whole. Now the four main panels of personality which present themselves for investigation are the hereditary unit characters found in the domains of anatomy (morphology), physiology, psychology and immunity. Each of these may be considered to occupy one panel of the great screen across which man's personality is drawn. Now it has been found that if the four panels of personality be studied and correlated in each person of a large number of individuals, one soon realizes that there is frequent repetition of certain combinations of characters. These recurrences are so definite that from a careful analysis of a given morphologic panel it is possible to predicate with great correctness the nature of the other panels. By such a plan of the most direct and objective study of human beings it is often amazing how much can be learned of their varied individual qualities. Indeed, one comes to realize now how valuable and keen were the findings of certain of those supposedly fanciful observers—the physiognomists and phrenologists. Petrus Camper, Blumenbach, Guvier and Levater made contributions to the study of man which are of great value to physicians.

There has of course always been much discussion of the value of morphology as a criterion for classification of the human race. Anthropologists have depended very largely on body size and proportion as means to classify mankind into races. Medical men, too, have, since Hippocrates, striven to separate out types. If one reviews the literature, however, one is impressed by the fact that under a variety of different names two main types only of the human race have been described—the long narrow and the short broad. In our studies we have assumed that capacity to react with a specific external agent, that is the possession of specific susceptibility, was a basic unit character. Consequently, the appearance of a disease could properly be looked upon as evidence of the presence of that specific susceptibility. In other words, the presence of disease has been used as a means of classifying human beings. The racial factor which is common to all men does not appear to be of great consequence for this plan of inter-disease group comparison. We are not primarily concerned with an individual's position in a geographic classification of subspecies, but rather in that individual's position in respect of a grouping based on disease

potentiality. Furthermore, the factor of geographical race in this situation is confusing. This point is well illustrated by the instance of three cases of perforated gastric ulcer lying side by side in the Presbyterian Hospital at the same time. The likeness of the three, one to another, was striking, and anthropometrically their measurements and proportions were almost superimposable. Nevertheless, these three men sprang from three distinct racial roots—one an Anglo-Saxon, one a Pole from Middle Europe and one an Italian from the shores of the Mediterranean Sea. Obviously, these three individuals so similar in their morphology and in other attributes of personality, including a specific disease susceptibility, were not pure examples of their respective racial stock. They were mixtures originating from widely different sources. Then through the generations their antecedent germ plasm received infusions of other strains in certain proportion until these three phenotypes appeared, practically identical not only in respect of their bodily or mental habits, but also in their special disease potentialities. It may well be that the conception of race as we have so far held it is no longer tenable. Undoubtedly the increasing facilities for migratory movements during the last two or three hundred years have forever shattered the biologic isolation of the subspecies of man. Now, whether or not disease susceptibility as a criterion for grouping mankind will satisfy statesmen and political economists is a matter for discussion. Certain it is, however, that the preliminary studies of the psychologic panels of the different disease groups so far made suggest as wide a divergence in this phase as in the morphologic. Possibly a temporary reclassification of human beings on a disease potentiality basis will help to clear the blurring of differential characters which has resulted from extreme racial admixture. Furthermore, it would seem that the manner in which an individual relates himself to the social structure depends largely on his psychic pattern. Consequently, any method of study which clearly displays mental qualities may help in selecting the life work for which a given person is best fitted. Thus a system of classification based on disease potentiality serves a double purpose. On the one hand, it may well assist us to discover a man's specialized capacities for work, and, on the other, to preserve him for its accomplishment. For the physician, in any case, it is a form of classification of great importance.

Now to whatever classification of mankind studies of human constitution may ultimately lead, any objective method of investigation of whichever panel, be it morphologic, physiologic, psychic or immunity, will be forced to meet one direct and critical query. Which of the observed phenomena in the given phenotype are genotypic, and which are paratypic? Furthermore, in the case of genotypic characters which are truly idiotypic and which idiokinetic? Much has been written recently concerning these complex qualities of constitution, among which disease predisposition is one of the greatest in importance. Most writers on the subject recognize two phases, namely, inherited and inheritable (idiotypic) constitution, and influenced, non-inheritable (paratypic) constitution. Tandler and Julius Bauer speak of the latter as "condition." Very sharp question as to the dependability of morphology as an index of the presence of other inward or unseen qualities in the organism has been brought by students of genetics. As pointed out by Siemans and others, experiments with both plants and animals have repeatedly shown that in dominant inheritance a heterozygous individual may not be externally distinguishable from the homozygous; and that it is not possible to judge of other inherited factors from the externals of a heterozygous form. But it must not be forgotten that the predisposition to a given disease may well be a dominant character which can not appear until the appropriate disease arising from the clash with the specific external agent demonstrates its latent presence. Thus such a dominant susceptibility may lie unrecognized in a fortunate person who escapes the clash, just as an unexpressed recessive character does in the skipped phenotype.

Notwithstanding these important questions, however, we are becoming more and more convinced that the purely objective studies of the four panels and their correlation in members of definite disease groups yields evidence which justifies the assigning of greater importance to morphologic criteria than has heretofore been acceptable. If the phenotypes which we have studied are all paratypic variants, and none of them pure idiotypes at all, then whatever parakinetic forces have modified them must have acted equally on skeleton and predisposition. For certain it is that in the case of two such diseases as cholelithiasis and gastric ulcer anthropometric differences have been as wide and constant as any that have ever served in the past to differentiate the races of men. The fact that original pure racial idiotypes are rapidly disappearing, if indeed they are not altogether gone, does not preclude the possibility that within the resultant hybridized mass may be appearing new groups of phenotypes with similar disease potentialities, as illustrated, for example, by the three cases of perforated gastric ulcer already referred to.

One only has to mention a few of the outstanding differences found in the sizes and proportions of different parts of the skeletons of these two strikingly different disease races to realize the value to the

clinician of this sort of constitution study. The following measurements (averages) show a few of the characters which differ widely:

	Gastric ulcer	Gall bladder disease
Ponderal Index	34	44
Gonial Angle	112°	122°
Subcostal Angle	55°	73°
Ant. Index up. jaw	54	58
A. P. Thor. Diam.	212 mm.	256 mm.
A. P. D. Ch.h.	64	74

Similarly striking differences have been observed between other disease groups, as, for example, pernicious anemia, asthma, nephritis and pulmonary tuberculosis. The differences are not all found in the same parts of the body, but may be equally great. Furthermore, certain interesting but as yet not altogether comprehensible differences and lack of differences between the sexes in each disease group have appeared. So far as we have been able to analyze the material it appears that there are three ways in which the sex factor enters into the relationship between constitution and disease. In the first place, there is the situation wherein both sexes display diminished secondary sex characters and likewise present the eunuchoidal trunk extremity ratio.

Thus for example both sexes in the pernicious anemia race have shown short trunks and long extremities, the so-called eunuchoidal habitus. Their secondary sex characters furthermore have enhanced this picture of gonadal inferiority. But as Tandler and Gross have pointed out, this incomplete sex differentiation may actually disclose the basic species form common to both sexes. From this point the thought arises that without the protection of a fully differentiated sex influence certain idiotypes which carry a predisposition to easy blood destruction and poor hematopoesis develop pernicious anemia.

The second manner in which the sex factor finds expression is in those diseases which are found much more frequently in one sex than another. Thus, for example, gall bladder disease is three or four times more common in women than in men. But in addition to this well-recognized fact our studies have shown that the males who develop cholelithiasis clearly tend toward the fat avirile type, or may express the feministic trend in their psychic pattern. Furthermore, the male pelvis among gall bladder people is the widest of all males and females except that of the pernicious anemia females. This pelvic largeness is reflected again in the high bi-iliac-bi-acromial index of the males of the gall bladder race. From these observations it would seem not unreasonable to suppose that the more completely differentiated individuals are toward maleness or femaleness, the less close should be their predispositions for those diseases in which the sex factor is a determining one. Possibly when studies of all the panels are completed and correlated it will be found that those individuals of one sex who succumb to a disease chiefly encountered in the opposite sex should exhibit signs of an incomplete differentiation toward their own sex.

The third way in which the sex factor may manifest itself is not as well defined as are the two preceding. Briefly, it appears that when the sex character differences are accounted for there remain marked differences between the sexes in those morphologic characters which are criteria of species. These latter differences are most marked in the group of nephritics. Thus among other things the females of the nephritis people have relatively longer abdomens, lower pelvis, lower sternum, lower set umbilicus and relatively greater length of long bones than the male. It is as though the external agents clashed with the predispositions of males of one species and females of another to produce nephritis. If one could express it in terms of experimental animals it would be like saying that the nephritis group was composed of male fox terriers and female greyhounds.

These aspects of the influence of the sex factor in constitution have been perhaps the most interesting and unexpected outgrowths of the anthropometric studies. They are of course far from being firmly established and it is to be hoped that much more work may be done on this phase of the subject. There is no doubt either that the measurements and ratios have been in accord with other clinical observations upon the relationship of sex and disease.

In conclusion then it may be said that it has been found possible by direct observation to correlate morphology and predisposition to disease in the case of at least five well-recognized clinical entities. Obviously, there is no sharp line of difference between the disease races. Overlappings must always occur, for there is no absolutism in any hybridized living form. But notwithstanding these overlappings, there can be found in the morphologic panel alone a great deal of important information which throws light upon the other qualities of the phenotype. When we have achieved a dependable method of measuring the qualities of the other three panels and can correlate them properly, we shall begin really to understand something of that very particular constitution of a human being which is so great a force in determining success or failure in the battle of life.

GEORGE DRAPER

COLUMBIA UNIVERSITY
AND PRESBYTERIAN HOSPITAL

THE DIFFERENTIALS EFFECTIVE IN THE DISTRIBUTION OF PLANTS IN THE COASTAL PLAIN[1]

MATHEMATICIANS use the noun differential as expressive of infinitesimal differences between two values of a variable quantity. The student of plant geography finds likewise that he can speak of the differentials effective in the distribution of plants, for frequently slight unrecognizable changes in the character of the environment may have marked influence on the associations of plants which are found in two adjacent, but different habitats. Dr. Gregor Kraus has a remarkable book which sets forth these differences in small areas published as "Boden und Klima auf Kleinstem Raum."[2] What is presented in the following discussion will be drawn from the speaker's research study of the geography, geology, physiography and vegetation of the Atlantic Coastal plain from Nantucket in the north to Key West in the south.

Nantucket, Martha's Vineyard, Block Island and Long Island lie within the glaciated region and their soils and topography have been influenced consequently by glacial action. The rounded hills of Nantucket, with the exception of parts of the south shore of the island, are composed of loosely assorted sands and gravels with erratic boulders imbedded. This elevated land being wind-swept is covered with heath vegetation, the plants of which in the course of time have formed a raw humus. Here grow *Quercus nana, Quercus prinoides, Comptonia asplenifolia, Myrica carolinensis, Corema Conradii, Gaylussacia baccata, Vaccinium vacillans, Vaccinium pennsylvanicum, Arctostaphylos uva-ursi, Gaultheria procumbens, Hudsonia ericoides, Epigaea repens, Tephrosia virginiana, Baptisia tinctoria, Chrysopsis falcata, Sericocarpus asteroides.*[3] In earlier times, as evidenced by the remains, deciduous woodlands existed in the valleys, or hollows, where the trees were protected from the winds. As in other glaciated regions, kettle holes abound, and these basin-like depressions are filled either with water, forming lakes and ponds, or by bogs with the usual bog species. Instead of a uniform aquatic and bog flora for all the kettle holes, each depression has a flora of its own, for example, one pond will be covered with water lilies (*Nymphaea odorata*), another will be invaded with the swamp loosestrife (*Decodon verticillatus*). The margin of one pond will have an association of *Hypericum adpressum,* another a thicket of button bush (*Cephalanthus occidentalis*). The former embayments of the south shore of Nantucket, which at one time communicated with the sea, have been closed by sand bars on the ocean side, and their water is fresh, or after storms, when the waves break over the barrier beach, decidedly brackish. Where the currents have cut away the hills, high bluffs have been formed, as, for example, Sankaty Head, and these bluffs have been tenanted by characteristic species which thrive on the steep slopes where there is a constant down-slipping of the sand and gravel, of which they are composed.

Martha's Vineyard is a larger island than Nantucket and its topography necessarily more varied. Consequently we do not find the same effect of the wind, as Martha's Vineyard is covered more completely with forest. Besides it is nearer the mainland and less exposed. In the physiognomy of its flora, it is more like the adjacent part of New England. Block Island is a small island well out at sea. In the almost complete absence of trees it resembles Nantucket. There is a remnant of a deciduous woods in a well-protected depression or valley. Early in the history of Nantucket similar depressions were so filled. Kettle hole ponds are present, and, where not used by the farmers to water their stock, are filled with aquatic and bog plants, such as bog bean (*Menyanthes trifoliata*), the cotton grass (*Eriophorum*) and the floating heart (*Limnanthemum*).

Long Island has two parallel moraines which form its backbone and which represent the great terminal continental moraine along the axis of which the four islands here described are placed. The central part of Long Island from Great Peconic Bay westward through two thirds of the island is characterized by a series of hills representing the Ronkonkoma Moraine from the large kettle hole occupied by Lake Ronkonkoma in the middle of the island. These hills of loose, porous sands and gravels, which retain the water poorly, are covered with the pine barrens where the prevailing tree is the pitch-pine (*Pinus rigida*) and associated species adapted to grow in a barren soil which dries out quickly. Harbor Hill Moraine, which is best seen from Port Jefferson westward, is broken into by deep, finger-like fjords or bays, and where the moraine hills have been undermined by the waters of Long Island Sound, steep bluffs on which the plants have a precarious hold, have been formed. This north shore is characterized by a deciduous forest, for the rain water which falls on the hills breaks out to the surface along the lower slopes, and these conditions are conducive to the growth of broad-leaved trees. In the lower parts of the north shore

[1] Paper read at symposium of the Ecological Society of America on "The plant and animal distribution of the coastal plain," held in Washington, December, 1924, at the meetings of the American Association for the Advancement of Science.

[2] Jena, 1911. Verlag von Gustav Fischer.

[3] Harshberger, John W., "The vegetation of Nantucket," *Bull. Geogr. Soc. Phila.*, XII: 70–79, April, 1914.

valleys, where fine springs gush forth, moisture-demanding trees are found, such as the beech, tulip, black walnut and sycamore. West of the pine barrens the low hills which represent Hempstead Plain are treeless and covered with a natural prairie, vegetation first fully investigated by Dr. Roland M. Harper.[4] It seems that this natural prairie has existed always, and the speaker is inclined to go back to glacial times to account for its origin, for the soils represent the outwash materials of a glacial fan which on the retreat of the glacial ice were ready for occupancy by plants. The invasion of the prairie species probably took place at that time and by the formation of a dense and unbroken mat of roots and overground parts has prevented the invasion of tree species which surround the plain on all sides. The proof of this statement is that when the ground is broken for cultivation tree species will thrive.

The Hudson River and New York Bay were efficient barriers in the former spread of coastal plain plants from south to north, for Stone[5] has shown that the so-called pine barrens of Long Island are decidedly weak in the characteristic pine-barren plants. Of 62 species listed for this region, only 26 are included in Stone's list of typical New Jersey pine-barren plants. New Jersey and North Carolina pine barrens have more in common.

When we study the coastal plain of New Jersey we find, if we draw a line west to east, the following types of vegetation: In the Delaware River Valley there are fresh-water, tidal marshes with the upland and interstream areas covered with deciduous forest. This is sometimes called the transition area, and the trees characteristic of it are willow oak (*Quercus phellos*), sweet gum (*Liquidambar styraciflua*), holly (*Ilex opaca*) and scrub pine (*Pinus virginiana*). Beech and tulip trees occur, but they are not confined to the coastal plain in these parts. To the eastward lie the pine barrens, which are about 45 to 50 miles wide. Here the pitch pine (*Pinus rigida*) and its associates are supreme.[6] Before reaching the salt marshes we pass a narrow strip east of the pine barrens where deciduous trees are found. Here the characteristic trees are holly, willow oak and sweet gum, but the scrub pine is absent. Skunk cabbage (*Symplocarpus foetidus*) comes into the northern part of this strip. The salt marshes fringe the open bays which separate the sandy beaches and dunes with their vegetation from the mainland. The distribution of plants across the state, as we have described their occurrence, is due fundamentally to differences in the soil. I have shown elsewhere[7] that the water-holding capacity of the soils represented in the above section of the state is as follows:

Dune sands	33.33 per cent.
Pine-barren soils	45.87 " "
Upper plain soils	46.00 " "
Deciduous forest soils	56.16 " "

The New Jersey plains (Upper and Lower), or speaking phytogeographically, the *Coremal*, because of the abundance of the broom crowberry (*Corema Conradii*), are peculiar in being covered with a dwarf, elfin or pigmy forest of pitch pines, oaks, laurel and other shrubs with a herbaceous undergrowth. It would appear from extensive research, which I have made, that the dwarfed character of the pines, oaks and other plants of the Coremal is due primarily to the stiff impervious subsoil and the light, easily dried, sandy surface soil. The elevated character of the country facilitates rapid surface drainage and the influence of elevation coupled with strong winds has a dwarfing effect on the plants exposed to such conditions.

The coastal plain of the southern United States, from Maryland to Texas, presents some interesting differentials. W. J. McKee has distinguished the Lafayette and the Columbia formations. The Lafayette, the older of the two, is a deposit of sandy clay, reddish or yellowish in color, varying considerably in thickness, lying unconformably on the Mesozoic and the Cenozoic strata over a vast area of the coastal plain. It is supposed to have been deposited just before the Glacial Period during a submergence of the coastal plain estimated to have lasted 60,000 years. In general it extends from Maryland to Texas and up the Mississippi Valley to Illinois. The Columbia formation in the northern coastal plain consists almost entirely of sand. It was probably laid down during a much shorter period of submergence contemporaneous with or subsequent to the glacial period. It is always above the Lafayette where the two come into contact. The Columbia formation covers a large part of the coastal plain from Long Island to Mexico and up the Mississippi and Ohio rivers to Indiana. In the middle and South Atlantic states it covers the whole area near the coast. The relation of vegetation to these deposits is marked. *Taxodium imbricarium*, one of the deciduous cypresses, always grows over the Lafayette formation in undrained swamps, while *Taxodium distichum* grows on the Columbia deposits and on others in drained swamps, but not on the Lafayette formation.

[4] Harper, Roland M., "The Hempstead plain," *Bull.* Amer. Geogr. Soc. XLIII: 351–360, May, 1911; *Torreya*, 12: 277–286, December, 1912.

[5] Stone, Witmer: "Plants of Southern New Jersey," 1911, page 112.

[6] Harshberger, John W., "The Vegetation of the New Jersey Pine Barrens," 1916.

[7] Harshberger, John W., "The Vegetation of the New Jersey Pine Barrens," 1916.

I have outlined the differentials found in South Florida south of 27°30′ north in my book, "The Vegetation of South Florida" (1914). On the east coast of Florida are rolling sand plains and sand hills which extend from the north side of Indian River Inlet south to Hillsboro Inlet. It appears that these sand hills are ancient dunes formed by wind action, for the sand deposits have covered an older, flat land of limestone. These hills are covered with the sand-pine or spruce pine (*Pinus clausa*), with low oaks (*Quercus geminata, Q. minima, Q. myrtifolia*), the saw palmetto (*Serenoa serrulata*) and rosemary (*Ceratiola ericoides*) and other plants.

To the southward are exposures of oolithic limestone which are covered with slash-pine (*Pinus caribaea*) and an occasional silver thatch-palm (*Coccothrinax argentea*) and coontie (*Zamia integrifolia*). Around Princeton there are depressions in the limestone where broad-leaved hammock plants grow as islands in a sea of pines. Below Miami are everglade prairies which cut the slash-pine forest transversely. The delimitation of pineland and prairie is here very sharp. One can stand with one foot on the prairie and the other in the pine forest. The difference in elevation between pineland and prairie is only about a foot or eighteen inches. Back of the pineland occurs the fresh-water marsh, or fenland known as the Everglades. Here is a sea of saw-grass stretching unbrokenly to the horizon in every direction, the surface diversified by hammocks and groves of trees. The whole fen is threaded by channels which connect open lagoons filled with aquatic plants. Lake Okeechobee is a sufficiently large body of water to ameliorate the climatic of the south shore, for here we find a forest of custard apple (*Annona glabra*), a mile or two wide, bordering the south shore of the lake.

Stretching south and southwest from the extreme end of Florida there is an archipelago of approximately two hundred named islands known as the Florida Keys. First at the northeastern end of the chain are two sand islands, namely, Virginia Key and Key Biscayne, designated the Upper Sand Keys. Seven miles south of Key Biscayne is a second group of islands composed of coral rock extending from Soldier Key a distance of approximately one hundred and twenty miles to the West Summerland, or Spanish Harbor Keys. This section of the chain may be called the Upper Keys. Beginning with No Name Key and Little Pine Key is the third natural group extending in a western direction for thirty miles to Key West. The islands of this group are composed of Miami limestone and are known as Lower Keys. Westward of Key West reaching into the Gulf of Mexico lies the fourth section of the Florida Keys, composed of sand. These are the Lower Sand Keys. As one might expect these differences in the character of the materials composing the islands of the four groups of Florida Keys naturally influence the character of the vegetation. We find that to be the case, for the Upper Sand Keys maintain a sand-dune and hammock flora related to that of the coastal peninsula to the north. The Upper Keys are clothed with a dense hammock growth of tropical hardwood shrubs, trees and palms, resembling the vegetation of the Bahama Islands. The Lower Keys are more varied in their vegetation with large areas covered with pineland, palm groves and extensive hammocks.[8] Their vegetation suggests that of Cuba. The Lower Sand Keys are little more than bars of sand, shifting their position with the ocean currents and with the hurricanes that sometimes strike them so as to completely change their entire configuration. Dr. William R. Taylor informs me that a tropical hurricane may denude completely the coastal fauna and algal flora of these islands. The Lower Sand Keys support usually, like the ocean side of all the Florida Keys, the characteristic strand flora found on most of the West Indies.

The foregoing sketch indicates that from north to south, excluding the climate from consideration, the edaphic, geologic and physiographic differences are productive of differences in the flora, and if we consider the matter from the ecologic and phytogeographic aspects, these differentials are directly responsible for variations in the vegetation or ensemble of plant species as related to environment. Such a survey shows that there are many problems awaiting study, and the Atlantic coastal plain is favorably situated for such research, for many large cities are situated along its inner edge known as the "fall line" and the student can use these centers of population as providing the facilities for his investigation.

JOHN W. HARSHBERGER

[8] Small, John K., "Flora of the Florida Keys," New York, 1913.

BURT GREEN WILDER

DR. BURT GREEN WILDER, professor of neurology and vertebrate zoology, emeritus, in Cornell University, died at his home, 93 Waban Hill Road, Chestnut Hill, Mass., on January 20, 1925, in his eighty-fourth year.

Dr. Wilder was born in Boston on August 11, 1841, and traced his ancestry directly back to Thomas Wilder, one of the *Mayflower* passengers. His youth and early manhood were passed in the stimulating intellectual, moral and political atmosphere of New England; and he enjoyed the instruction and friendship of the great teachers Asa Gray, Oliver Wendell Holmes, Jeffries Wyman and Louis Agassiz. His well-known uprightness of character, his devotion to

what he believed to be right proved him to be a worthy product of these influences.

His preparation for college was made in the high school of Brookline, Mass. In 1862 he graduated from the Lawrence Scientific School (Harvard) with the degree of B.S. *in anatomia summa cum laude;* and in 1866 he received the degree of M.D. from the Harvard Medical School. After graduation from the Lawrence Scientific School in 1862, he entered the U. S. Army and served for three years in the 55th Massachusetts Infantry (colored), first as medical cadet, later as assistant surgeon and finally as surgeon. During this period, while stationed near Charleston, S. C., he began his investigation of the possibility of utilizing the silk of the silk spider (*Nephila clavipes*), the results of which he published later. He also published, later, accounts of the habits of several spiders, among which was the remarkable triangle spider (*Hyptiotes cavatus*). From 1866 to 1868 he was assistant in comparative anatomy in the Museum of Comparative Zoology, working under the direction of Louis Agassiz. He was also curator of herpetology in the Boston Society of Natural History.

In 1868 Dr. Wilder became a member of the first faculty of Cornell University as professor of comparative anatomy and zoology, having been recommended to President White for this position by Louis Agassiz and Asa Gray. In 1910 he retired from active service in the university after having been a leading member of its faculty for forty-two years. During this period there were several changes in the title of his department and in the scope of its work, due to the establishment of new departments to care for certain specialized divisions of the field. It was a marked characteristic of Dr. Wilder that as the university grew and as the young men associated with him became competent, he favored placing them in charge of separate departments, with apparently no thought that the restricting of his field lessened his own importance. During the later years of his service he was professor of neurology and vertebrate zoology.

In 1866 he delivered the Lowell Institute lectures in Boston. He was lecturer on comparative anatomy in the Anderson Summer School of Natural History which was conducted by Louis Agassiz at Penikese, 1873–74, and lecturer on physiology in the Medical School of Maine, 1875–84 and in the University of Michigan, 1876.

Dr. Wilder was a remarkably inspiring teacher. He was a brilliant lecturer. His lectures were expressed in faultless language and were filled with enthusiasm for his subject; this inspired his hearers to feel that the subject discussed was of supreme importance. He was fertile in devising experiments to illustrate his lectures, and made use of many anatomical preparations for this purpose.

He was an ardent believer in the importance of laboratory work, and from the first he encouraged the students to take it. Later he became convinced that a certain amount of such work should form an integral part of every general course in natural science; so that even with classes numbering two hundred, a third of the time was given to the practical exercises, or "practicums" as he termed them. The accumulating and preparation of the specimens required for this involved much labor and considerable expense, but was cheerfully done. This began in 1880–81 in zoology, and in 1886–87 in physiology. At that time this was a new feature in the teaching of large general classes, but it has since become quite generally adopted.

For many years Dr. Wilder had no private laboratory, but pursued his investigations at a table in the general laboratory, where he was a constant inspiration to the students working there. The writer recalls vividly with what enthusiasm he used to call us about him in order to point out some step in advance in the research he was making. One can imagine nothing more stimulating to the young student than experiences of this kind.

Dr. Wilder was in the habit of urging his students to strive in composition for *clearness, consistency, correctness, conciseness* and *completeness.* These he called his five C's. He always placed clearness first. He said on one occasion: "It does not make any difference whether what you say is true or not, if it is clear."

He was a very humane man; nothing would arouse his wrath more quickly than to see a dumb animal mistreated. At his home or laboratory there was always one or more pets which he cherished.

The number of students who were taught by Professor Wilder is very large. For nearly thirty years, at the wish of President White, who laid great stress upon an elementary knowledge of physiology by all students, he delivered a course of lectures on the principles of physiology and hygiene, which were attended by all freshmen. At the same time many students were enrolled in the more special courses.

As an evidence of the high regard in which Dr. Wilder was held by his former pupils, some of them upon his completion of a quarter of a century of service in the university prepared and published a volume of original contributions to science, "as a testimonial of their appreciation of his unselfish devotion to the university and in grateful remembrance of the inspiration of his teaching and example."

This volume was entitled "The Wilder Quarter-Century Book" and included original contributions to science from fifteen of his former pupils. This, so far as is known to the writer, was the first American adoption of the German plan of honoring a beloved professor by the publication of a *Festschrift.*

The results in teaching and in research accomplished

by Dr. Wilder during the early years of the university illustrate what can be done by an earnest man in spite of lack of facilities now regarded as essential. He had no assistance except from students; but little apparatus, for a long time there was not a single microscope in the laboratory and then but one which was rented; a departmental stenographer was unthought of in those days. It was under these conditions that many men now widely known for their contributions to science received their early training and under which Dr. Wilder published many papers.

In the earlier years Dr. Wilder devoted his attention to various zoological problems; but later he gave most of his time to a study of the morphology of the brain, and to a simplified terminology of the parts of the brain. He prepared nearly two thousand vertebrate brains, many of which are human, including thirteen from educated persons. This collection is now at Cornell University. In 1867 he devised the "slip-system of notes," the use of which has become universal.

His published works include "What Young People Should Know," 1874; "Anatomical Technology" (with S. H. Gage), 1882; "Physiology Practicums," "Emergencies," 1883; "Health Notes for Students," 1890; "The Brain of the Sheep," 1903, numerous reviews and articles in magazines and in the "Reference Handbook of Medical Sciences" and several musical compositions.

After his retirement from Cornell he lived at Chestnut Hill, Mass., and at his summer place at Siasconset, Mass., and devoted himself to the preparation of his autobiography and to a history of the regiment with which he served during the Civil War, the 55th Massachusetts Infantry. He was engaged all day upon this work the day before he died.

Dr. Wilder was twice married. His first wife, Sarah Cowell Nichols, to whom he was married in 1868, died in 1904. His second wife, Mary Field, died in 1922. Two daughters survive. They are Mrs. Shepard Stevens, wife of a Yale professor, and Mrs. Robert R. Reed, of Washington, Pa.

J. H. COMSTOCK

CORNELL UNIVERSITY

SCIENTIFIC EVENTS

CLÉMENT ADER AND THE AEROPLANE[1]

M. CLÉMENT ADER, one of the pioneers of aviation, has died at Toulouse, at the age of 84. It is claimed in France that he was the first man to fly in a power-driven aeroplane, and he had come to be regarded in France as "the father of aviation."

An electrical engineer by training and engaged in the government service in the Department of Ponts-et-Chaussées, M. Ader devoted himself passionately to the study of flight from a very early age. One of his first efforts was a man-lifting kite. He had a large bird cage built in his garden at Passy in order to observe the flight of birds.

In 1886 he began to build a flying machine, and after four years' hard work brought it to completion. It was called the "Eole." His enterprise attracted some attention, but the trials were held in great secrecy, and the public was not quite sure whether the "Eole" had flown the few feet which were claimed for it or not. A second model was built a year later, but was wrecked while being tried at Satory. However, the government had become interested in his work and placed funds at his disposal for a fresh attempt.

Eventually, on October 14, 1897, a third machine, known as the "Avion," built by M. Ader, flew, it is claimed, though the question will ever remain in doubt, about 300 yards in the presence of representatives of the Ministry of War. It was a curious structure, with folding bat-like wings and twin screw propellers driven by a steam engine. M. Ader placed his plans at the service of the government, but his machine did not inspire sufficient confidence, and his offer was refused. This was a bitter blow to him. He had had to face ridicule and incredulity enough during his unsuccessful attempts, but to be discredited after half a lifetime's work had been crowned with moderate success was more than he could bear. He gave up his research work, burned his plans, and went into retirement in his native village of Muret, in the Haute-Garonne.

As flight progressed the value of Ader's experimental work was recognized, and he has long been given his proper place in the history of aviation. Last summer he was made a Commander of the Legion of Honor; a monument is to be erected at Satory on the spot where he made his flights, and the original machine is preserved in the Musée des Arts et Métiers.

All French military aircraft are now officially referred to as *avions* as a generic term for heavier-than-air machines of all types. The name was chosen in recognition of M. Ader's services to aviation.

[1] From the London *Times*.

CAPTAIN AMUNDSEN'S PROPOSED FLIGHT TO THE NORTH POLE

CAPTAIN ROALD AMUNDSEN has sent a message to the London *Times* from King's Bay, Spitzbergen, under date of May 1, as follows:

When this article appears in print, and if everything continues to develop in accordance with our plans, the trial flights will be over, and the start may take place any day. Up to the present everything has conformed to

the program. The work of landing and putting together the machines has been satisfactorily performed, notwithstanding certain obstacles, due to the ice conditions, and during the opening days of May we shall probably have nothing to do but to wait for a fine weather forecast.

We do not know on which day we shall start, but the start will be made at 4 o'clock in the afternoon, because at that hour the sun will be moving across the sky in such a way that for the next 12 hours no shadow from the wings of the flying boat will fall upon the solar compass, as the sun will be moving northward in the sky, drawing nearer to our course to the Pole.

On the completion of the trials the *Farm* and *Hobby* will proceed to the north coast of Spitzbergen. The meteorologists in the *Farm* will advise us in the morning when a suitable day for our flight arrives. We shall start from here in the morning and fly to the ships, which will be either at the edge of the Polar ice, or by the ice in one of the fjords. I can not say which alternative we shall choose. On arriving at the place selected we shall prepare for the final start.

The distance from the starting place to the Pole is 687 miles, which we expect to cover in eight hours in still weather. At first, with the machines loaded to full capacity, we shall fly at 93 miles an hour. As the load decreases with the consumption of petrol we shall reduce speed in order to save the engines. On the return flight the speed will be rather under 87 miles an hour.

My intention is to land as soon as our observations indicate that we are above the Pole. We shall then take careful observations in order to discover how far we are from the Pole before making our final spurt, which will be made on ski if we find that we are still a considerable distance away. Should we fail to discover a suitable landing place fairly near the Pole, we shall drop the Norwegian flag which we are taking with us, and then shape our course for Spitzbergen. A return without landing will not prejudice the geographical results, for at the height of 1,000 feet, we shall command an area ~~125~~ 80 miles in diameter.

THE BRITISH SCIENCE GUILD[1]

THE annual meeting of the British Science Guild was held in the Salters' Hall on April 21, the chair being taken by the Right Hon. Lord Askwith, president of the guild.

Reviewing the work of the guild, the chairman directed attention particularly to its coordinative functions, linking together the operations of many different bodies, and to its efforts to bridge the gulf between men of science and the general public. Reference was made to the issue of the revised edition of the Catalogue of British Scientific and Technical Books, which now contains more than 9,500 titles of books, and should prove most valuable to students, libraries and manufacturers. Methods of obtaining "science publicity" are being considered but this demands the cooperation of leading scientific and technical societies. A new feature has been the formation of six standing committees (National Security, Parliamentary, Health, Research and Industry, Finance and General Purposes).

An address emphasizing the need of increasing knowledge of science among the public, and the application of scientific method to public affairs, was delivered by Sir William Bragg, who pointed out the contrast between the marvelously rapid development of scientific data and the meager facilities for letting the public know what was being done on their behalf. The forty millions of people in the British Isles are living on the direct application of science, and they should know what science has done and what it might do in the future. It is unfortunate that scientific men, who spend their days in wresting information from Nature in the laboratory, have not as a rule the supplementary gift of conveying scientific information in a popular form. Publicity for science is needed. If, as it is hoped, a proper organization for publicity in scientific matters could be created, there should be at its head a scientific literary man, and behind it funds sufficient to tide over the first period of its existence.

Sir Arthur Newsholme, speaking as chairman of the health committee, said that the average life of a child born to-day is some 10 to 12 years longer than it was 30 to 40 years ago. This is due to a better knowledge of the laws of health. What should be investigated are the causes of evils rather than their alleviation—as illustrated by the millions of headache powders and similar nostrums sold. Attention has been directed by the health committee to two defects in the births and deaths registration bill now before Parliament. There is no valid verification of the fact of death, and the certificate of death should be regarded as confidential and lodged with the registrar and not handed to the nearest relative.

Major the Hon. H. Fletcher Moulton (chairman of the research and invention committee) pointed out that in regard to industry there is a gap similar to that remarked on by Sir William Bragg in connection with publicity. Manufacturers of Great Britain are sometimes blamed for not availing themselves more freely of the results of scientific researches. There is, however, a gulf between the man working in the laboratory and the business man. An intermediary, who could demonstrate to the latter how he would benefit from the application of science, is needed. It is in this intermediate stage that Germany has made such rapid progress.

UNPUBLISHED PREPARATIONS FOR "ORGANIC SYNTHESES"

THE suggestion has been made that "Organic Syntheses," an annual publication of satisfactory methods for the preparation of organic chemicals, can increase

[1] From *Nature*.

its scope of usefulness by making available directions for preparations which have been submitted for future volumes.

The following is a list of some of the preparations which are now being checked by the editors. Those who wish a copy of directions for some of the listed preparations can procure the same by writing to Henry Gilman, Iowa State College, Ames, Iowa.

Acetamidine	1-Methyl-2-pyridone
Acrolein	Myristic acid
Benzal pinacolone	Naphthaldehyde
Benzylaniline	Phenyl isothiocyanate
m-Bromobenzyl chloride	sym-Phthalyl chloride
o-Bromotoluene	Propionaldehyde
α-Cyano-β-phenylacrylic acid	Pyromellitic acid
Cyclohexyl-bromopropene	Pyrrol carboxylic acid
Furoic acid	Thiophosgene
Hydroxylamine base	Thymoquinone
p-Iododimethylaniline	o-Toluamide
p-Iodoguaiacol	m-Tolylene diamine
Mandelic acid	Viscose

THE SCHOOL OF MEDICINE OF THE UNIVERSITY OF CHICAGO

GROUND was to be broken on May 7 for the first of the new buildings for the School of Medicine of the University of Chicago. At 2 p. m. trustees and faculty members of the university, including Rush Medical College, gathered on the site, between 59th and 58th Streets, and Ellis and Drexel Avenues, for an informal ceremony. Dr. Frank Billings officiated at the giant scoop with which the first sod was turned. Among those invited to be present were members of the firm of Coolidge and Hodgdon, the architects, and William Adams, the general contractor.

There will be constructed as fast as possible buildings to cost more than $4,500,000, realizing in steel and stone a project which has been developing for ten years, and has been discussed for longer than that. Departments for medical education will be united with a great hospital structure and dispensary, the whole furnishing opportunities for research and instruction much greater than has been possible in Chicago heretofore.

The units, with their purpose, location and cost, will be as follows:

The Albert Merritt Billings Memorial Hospital. Will house more than 200 patients; it is to be built facing south on 59th street, overlooking the Midway Plaisance, between Ellis and Drexel avenues; this building will express all modern conceptions in hospital planning, for the most efficient care of the sick and for the teaching of medicine and surgery; the cost will be about $2,000,000.

The Epstein Dispensary. This will have an entrance from 59th street; it will be equipped for the care of a large number of ambulatory patients; cost, about $200,000; it is the gift of Mr. and Mrs. Max Epstein.

The Medical Building. To be built immediately north of, and adjoining the hospital and dispensary, on the west side of a large court; to cost about $450,000.

The Surgical Building. To be erected on the east side of the court, north of and adjoining the hospital; to cost about $400,000.

The Pathology Building. To be built at the north of the court; between and adjoining the surgical and medical buildings; will house laboratories and lecture rooms for the present university department of pathology; to cost about $650,000.

The Physiology Building. To be erected in the same block, but fronting on 58th street; will house the present university laboratories and lecture rooms for physiology; to cost about $425,000.

The Building for Physiological Chemistry and Pharmacology. Will adjoin the building for physiology, and be connected with it above the first story; to continue the present university work in physiological chemistry and pharmacology; to cost about $425,000.

The large area of land set aside includes space adequate for the erection, when funds become available, of buildings to be devoted to special branches of medical research, such as psychiatry and obstetrics. The buildings for surgery and medicine are given a central location with the hospital so that those for the special branches may be constructed in the unoccupied space from time to time and the whole plan be logically developed.

The staff of directors of the different branches of the School of Medicine has been completed by the appointment of Dr. D. B. Phemister, of Rush Medical College, as professor of surgery. Dr. Franklin C. McLean is professor of medicine and Dr. Ralph B. Seem director of the hospital. The department of pathology is headed by Dr. Ludwig Hektoen; the Otho S. A. Sprague Institute by Dr. H. Gideon Wells; the department of physiology by Dr. A. J. Carlson, and the department of physiological chemistry and pharmacology by Dr. F. C. Koch.

AWARD OF THE THOMPSON GOLD MEDAL OF THE NATIONAL ACADEMY OF SCIENCES

THE Thompson gold medal awarded by the National Academy of Sciences for distinguished service in the sciences of geology and paleontology has been given this year, by unanimous vote of the academy, to Dr. John M. Clarke, of Albany. The medal was presented at the annual dinner of the academy on April 29, Vice-president Dr. John C. Merriam presiding, who introduced Dr. Charles D. Walcott, chairman of the Thompson committee, by whom the medal was, in the absence of Dr. Clarke, presented to Dr.

James F. Kemp, with the request that he transmit it to the recipient. The Thompson medal, which was established for the purpose of recognizing the achievements of long service, has been awarded but twice before, first to Dr. Charles D. Walcott, and second to Emmanuel de Margerie.

THE FIRST AWARD OF THE JOSEPH LEIDY MEMORIAL MEDAL

AT a special meeting of the Academy of Natural Sciences of Philadelphia, held on May 12, the first award of the Joseph Leidy Memorial Medal was made to Dr. Herbert Spencer Jennings, of the Johns Hopkins University.

The Joseph Leidy Memorial Fund was created in 1923 as a trust with the academy, and was so announced at the Joseph Leidy commemorative meeting, held at the Academy of Natural Sciences on December 6, 1923. The fund was created by Dr. Joseph Leidy II, in memory of his uncle Dr. Joseph Leidy, one-time president of the academy. The fund provides for the award every three years of a bronze medal, accompanied by an honorarium, "as a reward for the best publication, exploration, discovery or research in the natural sciences in such particular branches thereof as may be designated."

The award of the Leidy Medal was made to Dr. Jennings on the recommendation of a committee of the academy, "in appreciation of his researches upon the Protozoa and the Rotatoria, and in recognition of his broad knowledge and keen understanding of the significance of biological phenomena."

The presentation of the award was made by Dr. Richard A. F. Penrose, president of the academy.

The medal is a bronze plaque bearing the head of Dr. Joseph Leidy, the distinguished zoologist, anatomist and paleontologist, on the face, and on the reverse the dates of his birth (1823) and death (1891), the name of the academy and that of the recipient and the date of the award.

Dr. Jennings delivered the address on the zoological work of Joseph Leidy at the Leidy commemorative meeting, and there is unusual appropriateness in his selection for the honor of the first award. A successor of Leidy in one of his fields of greatest endeavor, the study of the lower forms of animal life, and a philosophical zoologist with a viewpoint worthy of the man in whose memory the medal was founded, Dr. Jennings' selection has placed the standard for recipients of future award on a very high plane.

THE AMERICAN PHILOSOPHICAL SOCIETY

AT the annual meeting of the American Philosophical Society, Philadelphia, the following officers and members were elected:

President: Charles D. Walcott.

Vice-Presidents: Henry F. Osborn, William W. Campbell, Francis X. Dercum.

Secretaries: Arthur W. Goodspeed, John A. Miller.

Curator: William P. Wilson.

Treasurer: Eli K. Price.

Councillors: To serve for three years—Thomas B. Osborne, John F. Lewis, William M. Wheeler, William Trelease.

Members: Residents of the United States—Edwin A. Alderman, Charlottesville, Va.; Annie J. Cannon, Cambridge, Mass.; Arthur Holly Compton, Chicago, Ill.; Charles Day, Philadelphia, Pa.; William King Gregory, New York City; William Draper Harkins, Chicago, Ill.; Lewis R. Jones, Madison, Wis.; Elliott Proctor Joslin, Boston, Mass.; Andrew Cowper Lawson, Berkeley, Calif.; George Grant MacCurdy, New Haven, Conn.; Howard Hawks Mitchell, Philadelphia, Pa.; James Alan Montgomery, Philadelphia, Pa.; Edward Kennard Rand, Cambridge, Mass.; Edgar Arthur Singer, Jr., Philadelphia, Pa.; Joel Stebbins, Madison, Wis.

SCIENTIFIC NOTES AND NEWS

GIOVANNI BATTISTA GRASSI, director of the institute of comparative anatomy in the University of Rome, noted for his experiments on the control and prevention of malaria, died on May 5. Professor Grassi was a member of the Italian Senate.

M. ALBIN HALLER, professor of organic chemistry at the Sorbonne, Paris, and director of the Paris Municipal School of Industrial Physics and Chemistry, has died at the age of seventy-five years.

DR. PAUL M. REA, of the Cleveland Museum of Natural History, has been elected president of the Ohio Academy of Science.

PROFESSOR HAROLD R. HAGAN, of the University of Utah, was elected president of the Utah Academy of Sciences at the recent meeting held in Salt Lake City.

THE Northwest Scientific Association elected as president Dr. C. H. Clapp, president of the University of Montana, at the second annual meeting held at Spokane, Washington.

DR. CHREE, superintendent of Kew Observatory, England, has retired.

PROFESSOR BOHUSLAV BRAUNER, director of the Chemical Institute of the Charles University of Prague, celebrated his seventieth birthday on May 8.

AMONG the honorary degrees to be awarded by the University of Glasgow on June 24 are the doctorate of laws on Sir John Bland-Sutton, president of the Royal College of Surgeons; on Lord Ronaldshay, president of the Royal Geographical Society, and on M. Martin T. Tuffier, professor of surgery in the University of Paris.

DR. CABANES, the medical historian and editor of the *Chronique médicale,* has received the Cross of the Legion of Honor.

SIR THOMAS H. HOLLAND, rector of the Imperial College of Science and Technology, South Kensington, and formerly director of the Geological Survey of India, has been elected president of the British Institution of Mining and Metallurgy.

AT the annual meeting of the New York chapter of the American Institute of Chemists on May 7, the following officers were elected for the year 1925–26: *President,* Dr. Arthur E. Hill, professor of chemistry at New York University; *Vice-president,* Chas. E. Downs, consulting chemist; *Secretary-treasurer,* Ralph S. Doubleday, chief chemist, G. W. Carnick Company.

THE council of the Institution of Civil Engineers, England, has made the following awards in respect of papers read during the current session: A Telford Gold Medal to Mr. Donald Paterson (Johor Bharu); a Watt Gold Medal to Dr. E. H. Salmon (London); a George Stephenson Gold Medal to Mr. L. H. Savile (London); Telford premiums to Mr. G. Mitchell (Aberdeen), Dr. T. E. Stanton (Teddington), and Mr. F. F. Wentworth-Sheilds (Southampton); a Crampton prize to Professor A. H. Gibson (Manchester); and a Manby premium to Mr. P. W. Robson (Lincoln).

DR. ROBERT D. COGHILL has been reappointed a research fellow in the Graduate School of Yale University and will continue his investigations on the "Chemistry of tubercle bacilli" in cooperation with Professor Treat B. Johnson, head of the division of organic chemistry, of the Sterling Chemistry Laboratory. This research in tubercle bacilli is supported by a special grant from the National Tuberculosis Association.

THE Association to Aid Scientific Research by Women has awarded the Ellen Richards Research Grant of $1,000 for the year 1925 to Katherine MacFarlane Chamberlain, D.Sc. (Michigan, '24), instructor in mathematics in the College of the City of Detroit. Eighteen theses were submitted: 8 from the United States, 7 from England, 3 from Wales and one from South Africa; and while no one of the theses, in the opinion of the judges, merited the prize, as the standard set by the association is very high, Dr. Chamberlain was given a grant for further research. Her work was on "The fine structure of certain x-ray absorption edges."

ACCORDING to a press despatch, the German Academy for Scientific Research and the Cultivation of Germanic Culture was organized in Munich on May 5 with eighty-nine charter members, including Dr. Franz Boas, professor of anthropology at Columbia University.

DR. RICHARD LIGHTBURN SUTTON, professor of dermatology at the University of Kansas, has been elected a fellow of the Royal Society of Edinburgh.

MISS MAUD SLYE, member of the Otho S. A. Sprague Memorial Institute, has been elected a foreign member of the Deutsches Zentral-Komitee zur Erforschung und Bekämpfung der Krebskrankheit of Berlin.

RECENTLY the Kyoto Imperial University of Japan conferred on Kanematsu Sugiura, of Memorial Hospital, and the Harriman Research Laboratory, Roosevelt Hospital, New York, the degree of doctor of medical science, for his "meritorious work upon experimental cancer."

PROFESSOR ARTHUR A. ALLEN, of Cornell University, has been awarded the 1924 Outdoor Life Gold Medal for the Eastern States, in recognition of his work on a disease which affects ruffed grouse.

JOHN T. CAINE, formerly of the Utah Agricultural College, has been appointed head of the packers and stockyard administration of the U. S. Department of Agriculture to succeed Chester Morrill, who has resigned.

R. D. LANDRUM, formerly vice-president of the Vitreous Enameling Company and the Vitreous Steel Products Company and president of the American Ceramic Society, has become general manager of the ceramic materials department of the Titanium Alloy Manufacturing Company, of Cleveland, Ohio.

JOHN R. WINSTON, for nine years in charge of the U. S. Citrus Disease Field Laboratory at Orlando, Florida, has resigned his position in the Bureau of Plant Industry to accept a position with the Peninsula Chemical Company, Orlando, Florida.

WALLACE W. BOONE has resigned as assistant professor of metallurgy at the University of Cincinnati. He goes to Detroit as metallurgist with the American Radiator Company.

DR. FRANK P. UNDERHILL, professor of pharmacology and toxicology at Yale University, has accepted an invitation from the General Education Board to spend the next academic year visiting European universities.

DR. NICHOLAS KOPELOFF, associate in bacteriology at the Psychiatric Institute, Ward's Island, N. Y., sailed for Europe on April 29 for a two months' visit.

DR. GERALD L. WENDT, dean of the school of chemistry and physics at the Pennsylvania State College,

will attend the International Congress of Pure and Applied Chemistry at Bucharest, Roumania, during the week of June 21 and will spend the summer in Europe.

DR. HANS MOLISCH, professor of plant physiology at the University of Vienna, was a recent visitor to the United States, on his way to Vienna from the Imperial Tohoku University, Sendai, Japan, where he has spent the last two years organizing the department of plant physiology.

DR. J. BASIL HALL, president of the British Medical Association, was the guest of the Chicago Medical Society on May 13.

THREE members of the Colorado Museum of Natural History will start on an expedition this month to explore the "River of Doubt," in the interior of Brazil. The party, which will collect specimens of animal and plant life for the museum, consists of F. Walter Miller, mammalogist; Frederick E. d'Amour, photographer, and Frederick Brandenburg, taxidermist.

PROFESSOR MARSTON T. BOGERT, of Columbia University, is making a lecture tour under the auspices of the St. Louis section of the American Chemical Society and other scientific organizations. The subject of his lecture is "Science and art in the perfume industry." The tour included earlier in May the cities of Pittsburgh, Columbus, Cincinnati, Indianapolis and Lafayette. He will lecture in Urbana, St. Louis and Columbia on May 25, 26 and 27, respectively.

PROFESSOR W. M. DAVIS has returned from a winter beyond the Mississippi where he lectured at various institutions, beginning in Texas at the Southern Methodist University at Dallas and Rice Institute at Houston, then at the State University, Tucson, Arizona, but chiefly in California, at Riverside Junior College, Pomona College, the State University at Berkeley and at Southern Branch at Los Angeles and Stanford University; also at the Natural History Museum, San Diego, and the Scripps Institution, La Jolla, and before the Branner Club in Los Angeles, the Le Conte Club in Berkeley and the Sierra Club in San Francisco. Returning, stops were made at the State Universities in Reno, Nevada, and in Salt Lake City, Utah, and at Brigham Young University, Provo, Utah; finally at the University of Cincinnati and Berea College, Kentucky. Between lecture engagements many excursions were made, including one of a week with Mr. Levi F. Noble, of the U. S. Geological Survey, to Owens, Panamint and Death Valleys in southwestern California, where abundant evidence for the fault-block origin of several Basin Ranges was found. A statement of results gained there and in Utah was made before members of the U. S. Geological Survey in Washington.

DR. J. C. ARTHUR, professor emeritus of botany in Purdue University, gave two lectures during April, before the botanical department of Cornell University and of the Pennsylvania State College, and the graduate school of the U. S. Department of Agriculture. The subjects presented were the outlook for botany fifty years ago, and the rusts as at present understood.

AT a meeting of the Pennsylvania State College Branch of the American Association for the Advancement of Science held on May 5, 1925, Dr. A. B. Stout, of the New York Botanical Gardens, was the principal speaker. "Sterilities in plants" was the subject of his lecture, in which he told of the results of investigations with various species of wild and cultivated plants. Dr. J. C. Arthur was present and told something of his connection with the American Association over a period of fifty years.

DR. A. C. BEAL, professor of floriculture in Cornell University, recently delivered a series of six lectures on "The history of gardening and the use of flowers" before the Horticultural Society of New York and the Garden Club of America at the American Museum of Natural History, New York.

DR. E. D. ADRIAN delivered the Oliver-Sharpey lectures of the Royal College of Physicians, London, on May 5 and 7, on "The interpretation of the electromyogram," and Dr. S. A. Kinnear Wilson will give the Croonian lectures on June 9, 11, 16 and 18 on "Disorders of motility and of muscle tone, with special reference to the Corpus Striatum."

A COURSE of ten lectures on the biological aspects of normal and morbid psychology are being delivered by Sir Frederick Mott, in the medical school buildings of the University of Birmingham, commencing on April 30.

CEREMONIES were held throughout Russia on May 7, in honor of the memory of the late Professor Alexander Popoff, of the Electro-Technical Institute, who, according to Soviet claims, was the discoverer of wireless telegraphy. The Kronstadt Electrical Academy has been renamed after Professor Popoff.

SIDNEY J. LOCKNER, professor of mathematics at the University of Pittsburgh, died on May 10, aged fifty-five years.

MAJOR WILLIAM HALSTED WILEY, for nearly fifty years a publisher of scientific works, and a member of the firm of John Wiley & Sons, Inc., established by his grandfather in 1807, and formerly treasurer of the American Society of Mechanical Engineers, died on May 2, aged eighty-three years.

DR. VICTOR JACQUES, a well-known Belgian anthropologist, honorary professor in the faculty of medicine of the University of Brussels, has died at the age of seventy-one years.

DR. W. H. JULIUS, professor of experimental physics since 1896 in the University of Utrecht and known for his work in astrophysics on anomalous dispersion, died on April 15, aged sixty-four years.

THE deaths are announced by *Nature* of Professor Eduard F. L. Mazelle, formerly director of the Observatory, Trieste, a corresponding member of the Vienna Academy of Sciences, distinguished for his work on meteorology and seismology, aged sixty-two years, and Dr. V. Ebner, Ritter v. Rofenstein, emeritus professor of histology in the University of Vienna, aged eighty-three years.

WE learn from *The Electrical World* that in the sudden and unexplained sinking of the Mississippi River boat *Norman* about 12 miles south of Memphis on May 8, twelve members of an inspection party from the first annual convention of Mid-South engineers at the city named lost their lives, as well as five women of their party, a boy and four members of the crew. The male passengers who lost their lives were civil engineers, some of them of prominence in the profession. They include Paul H. Norcross, consulting engineer, Atlanta; William M. Gardner, United States assistant engineer, Memphis; Walter G. Kirkpatrick, professor of municipal engineering, University of Mississippi, and Robert H. McNeilly, professor of civil engineering, Vanderbilt University, Nashville, Tenn. More than a hundred engineers and their friends had embarked on the doomed boat.

THE Rockefeller Foundation gave a dinner in New York City on April 24 in honor of the Latin-American health officials who are on a two months' visit in this country under the auspices of the health section of the League of Nations. George E. Vincent, president, Rockefeller Foundation, was toastmaster, and among the speakers were Dr. Hugh S. Cumming, surgeon general, U. S. Public Health Service; Dr. Andres Gubetich, of the faculty of medicine at Asuncion, Paraguay, and Dr. Anthony J. Lanza, executive officer of the National Health Council.

THE American Society for Testing Materials, which will hold its twenty-eighth annual meeting at Atlantic City, N. J., on June 23–26, will at that time take action upon a recommendation of the executive committee for the establishment, at a cost of about $6,000, to be subscribed by the membership, of a Charles B. Dudley medal and an Edgar Marburg lecture. The medal, to be named for the first president of the society, will, if authorized, be awarded to the author or authors of a paper of outstanding merit presented before the society and constituting an original contribution on research in materials, with the understanding that if no paper in any given year seems to merit this distinction, the award will not be made. The lecture, to be named for the society's first secretary, will, if authorized, afford an opportunity for the society to be addressed by leaders in the field of engineering materials who will present outstanding developments in the promotion of knowledge of such materials. It is proposed that in this selection consideration be given to the plan of engaging foreign lecturers at suitable intervals and as the funds permit.

UNIVERSITY AND EDUCATIONAL NOTES

APPROPRIATIONS made by the State Legislature to the University of Michigan include $900,000 for a new museum and $500,000 for land.

THE sum of $400,000 has been contributed by friends of Professor J. Bentley Squier, to Columbia University for a urological clinic, which will bear his name.

GIFTS to the University of Pennsylvania amounting to approximately $300,000 are provided for in the will of the late James R. Magee to create memorials for two brothers, who were graduates of the university.

THE dedication of the new building for biology at the University of Texas took place on May 11, 12 and 13, when addresses were made by Professor Charles Atwood Kofoid, of the University of California, and Professor William L. Bray, of Syracuse University.

DR. L. C. PETRY has been appointed professor of botany at Cornell University in the position recently vacated by Dr. J. R. Schramm. Dr. Petry has been for several years on the botany staff of Syracuse University, in which institution he has also been director of the summer session.

DR. ARTHUR J. HILL, of the Sterling Chemistry Laboratory of Yale University, has been promoted to a full professorship in organic chemistry by the Yale Corporation with assignment to the governing board of the Sheffield Scientific School.

DR. HARRY DEXTER KITSON, professor of psychology in the University of Indiana, has been appointed professor of education in Teachers College, Columbia University.

THE trustees of Columbia University have an-

nounced the appointment of Dr. Robert A. Lambert as professor of pathology and director of the School of Tropical Medicine in Porto Rico; Dr. Nathaniel R. Norton as professor in the department of diseases of children, and Drs. William C. Johnson and William C. Von Glahn, assistant professors of pathology to be associates in that department.

DISCUSSION AND CORRESPONDENCE

THE KENNELLY-HEAVISIDE LAYER

IN connection with the transmission of electric waves, we now hear much concerning a reflecting atmospheric layer some forty kilometers above the earth's surface, and quite generally known as the Heaviside layer. It is not so generally known that Professor A. E. Kennelly announced the probable existence of such a layer prior to its announcement by Oliver Heaviside. The latter some time in December, 1902, in Vol. XXXIII, tenth edition, Encyclopedia Britannica, in an article on telegraphy, suggested a conducting layer in the upper air.

Kennelly published his paper "On the elevation of the electrically-conducting strata of the earth's atmosphere" in the *Electrical World and Engineer,* New York, March 15, 1902. It deals directly with the problem of long distance wireless wave transmission, and includes a remark which is of significance to aerographers; namely, that

> As soon as long distance wireless waves come under the sway of accurate measurement, we may hope to find from the observed attenuations, data for computing the electrical conditions of the upper atmosphere.

An interesting sidelight on the matter is the remark of C. Bouthillon, in *L'Onde Électrique,* June, 1923, where, in a critical review of the theory of propagation of these waves, it is stated:

> Le premier savant qui ait précisé l'idée est Kennelly, qui, dès 1902, fixait à 80 km. environ la hauteur de la coche refléchissante. Vers la même époque, O. Heaviside, Henri Poincaré, A. Blondel, Ch.-Ed. Guillaume, émettaient des hypothèses semblables.

This layer is destined to play an important part in future studies of the stratification of our atmosphere, especially at great heights.

I have in some lectures compared the atmosphere to a six-story building.

The first story, with ground floor, is the troposphere, in which the temperature falls at a fairly constant rate with elevation. This story is not of equal height around the world, but bulges up near the equator and slopes down near the poles. In our latitudes the ceiling is about 10 km (6 miles) above the floor. There is a mezzanine gallery about 0.5 km above the floor; and just as in the big buildings we are familiar with, the accounting offices are placed here. Notwithstanding those who regard variation in solar radiation as the source of weather and take the elevator to the roof, we will continue to do business and settle our weather accounts at these offices on the lower floors.

The second floor is the stratosphere, discovered and named by Teisserenc de Bort. The temperature gradients are horizontal instead of vertical. There are no clouds on this floor.

Somewhere about 40 km high is the third story; and in all probability this will be found to be the Kennelly-Heaviside region.

As yet the floor and ceiling are conjectural.

The fourth floor is the domain of meteors—and if we are to follow recent estimates, the temperature is actually warmer than in the mezzanine offices thirty-six miles below. This also is conjecture.

The fifth floor is the old top of the atmosphere—the twilight arch region, which comes out by triangulation about 80 km, but is more likely 65 to 70 km because of refraction errors.

The sixth floor is the region of auroral displays. The upper edges of auroral arcs according to Störmer are as high as 150 km; but the rays go still higher, often to 300 km.

The sixth story is also the roof. All above we call the Empyrean and turn the space over to astronomers.

So it seems that our six-story airshell is not such a skyscraper, after all. If we represent the distance from the earth's center to the surface by 1,000 bricks laid end to end, then the thickness of the sensible atmosphere could be represented by one brick. The highest level yet reached by man would need a trifle more, the highest actual record obtained by man would need about six bricks; and to reach an aurora sixteen bricks would be needed.

ALEXANDER MCADIE

BLUE HILL OBSERVATORY,
READVILLE, MASS.

MUSICAL ECHOES

SOME time ago there appeared in SCIENCE an interesting article on "Musical echoes." The author of the article might be glad to have his attention called to another example of such echoes reported in the April number of *Blackwood's Magazine,* on page 469, "In Lapland," by Jan Gordon and Cora J. Gordon.

> Under the high and purplish cliffs of the other side of the lake, we had a peculiar experience in acoustics; the clatter of the motor was gathered up and reflected back by these scarped rocks in a hundred echoes, but by some strange trick blended in so peculiar a fashion that the vulgar rattle and roar came to us sweetened into the chiming of cathedral bells, pastoral England's Sunday morning unbelievably imitated, now surging louder, now

drifting fainter, as one would hear the bells themselves in a shifting breeze.

C. MACFIE CAMPBELL

HARVARD MEDICAL SCHOOL

A HISTORIC FOSSIL

BOTANISTS and paleobotanists will be interested to hear that I have just received through an extraordinary courtesy of the custodians of the Zwinger Museum of Dresden a wedge cut from the historic cycadeoid *Raumeria Reichenbachiana*. This great petrifaction was first observed near Lednice, about three miles from Wieliczki in the salt region to the southeast of Cracow, in the year 1753. It was sent to Dresden by an engineer named Borlach in 1755, and thus has a longer museum history than any other cycadeoid. It is also the finest of all European trunks, and in fineness of structure is not surpassed by any American species. The true horizon is not yet known; but the trunk, along with the Silesian Raumeria Schulziana, must pertain to some horizon in the Galician Carpathians about equivalent to the Como or to the Lakota of the Black Hills.

The wedge was cut under the supervision of Dr. R. Kraeusel at Frankfurt am Main. It is ample for all study and comparison with the American and European forms. It carries nine complete floral axes, including the world-famous flower-bud illustrated by Goeppert in 1853, but, as so often happened with the cycadeoids, never studied. Paleobotanists will appreciate the fine discrimination shown by Dr. Kraeusel in taking his own initiative in cutting the wedge surface exactly to plate size for quarto illustration, while Americans may generally feel a deep satisfaction that an American laboratory has been entrusted with the investigation of this unique and famous fossil, certainly one of the three most celebrated fossils ever to reach this country from Europe.

G. R. WIELAND

YALE UNIVERSITY

A PHILIPPINE RORQUAL

A LIVING specimen of the small sharp-nosed rorqual, *Balaenoptera rostrata* Gray, 32 feet long, was captured in Manila Bay, having stranded near Bacoor, Cavite Province, January 3, 1925. The animal died that afternoon and was hauled out on shore. Some speculative Filipinos paid 400 pesos for it, thinking to make a fortune by having it mounted for exhibition purposes. When seen by me about the middle of the forenoon of January 5th it was in an advanced state of decomposition, and the outer layer of skin was peeling off badly. The whale was shiny black above and much darker than given by Beddard in "A Book of Whales." The black faded to grayish black and dirty gray on the sides and posteriorly; the plaited folds of the throat and belly were yellowish white. The long shaggy bristles of the baleen were gray. The animal was a male and the pressure of the gases of decomposition forced out of the body the rigid penis. This organ was slender, rather pointed and small for so large an animal, being about 14 inches long. No parasites were found on the skin or in the mouth; it is probable that the brackish water in which the whale was kept at first had killed any parasites present and they had dropped off. This is the first record of this mammal from the Philippines.

ALBERT W. HERRE

BUREAU OF SCIENCE, MANILA

LEGISLATION ON THE TEACHING OF EVOLUTION

THERE appears in the recent translation of Kammerer's "Inheritance of Acquired Characteristics," by A. Paul Maerker-Branden, the following statement:

> Unfortunately, the so-called "fundamentalists," led by William Jennings Bryan and clergymen of different denominations—it seems unbelievable, but it is the sad truth—have succeeded in excluding evolution of man from the curriculum of the schools of North Carolina and Kentucky.

This statement is in part, at least, erroneous. Both of these states have recently had bills presented in the legislature to prohibit paying the salary, from state funds, of teachers presenting the theory of evolution as a fact. In each case the bills were defeated; in North Carolina by a vote as reported by newspapers of 64–46. Furthermore, the matter was voted on in North Carolina after the publication of this book. The vote in Kentucky was taken a couple of years ago and was closer.

This statement is made in order to "keep history straight."

BERT CUNNINGHAM

DUKE UNIVERSITY,
DURHAM, N. C.

SCIENTIFIC BOOKS

Genetics and Eugenics. By W. E. CASTLE. Cambridge, Harvard University Press, 1924, viii + 434 pp.

A THIRD edition of Castle's "Genetics and Eugenics" is an event worthy of more than passing notice, especially since the new edition contains so much new matter. A new part has been added, devoted to the biological basis of genetics, which helps orient the reader concerning such fundamental matters as the cell, cell-division, reproduction (asexual and sexual), chromosome reduction and gametogenesis, variation in chromosome number, the chromosomes and

sex. In the main part of the book Castle sets forth the essential facts of genetics. Here he lays stress on the unit character principle—a principle whose importance is not proving to be as great as was anticipated. Apparently particular genes no more produce exclusively particular unit characters than particular endocrine glands affect merely particular somatic qualities. But there are prevailing or characteristic somatic effects which we associate with the presence or absence of particular genes. Castle would perhaps not accept this view, although it would help his own interpretation of his selection experiments. But that interpretation is now abandoned by Castle for that of gene mutation and multiple factors; and his presentation of the hypothesis of multiple factors is particularly clear. Many other complications in heredity are considered fully and clearly, such as mutations both in gametes and in soma (bud mutations). Inbreeding and cross-breeding are fully discussed; and the ground for the settlement of the long-standing controversy as to harmfulness of inbreeding is shown. Heredity of sex is rather fully considered.

Castle passes then in some new chapters very briefly to certain applications of genetical discoveries; improvement of live stock and of the human species. To the latter a whole part of the book is devoted, but this has not been greatly changed from the second edition. Finally, to the bibliography a large addition has been made, giving concrete evidence of the continued fecundity of genetical research.

Castle's "Genetics and Eugenics" is probably the standard college text-book covering the whole field in broad fashion. Its popularity is well deserved. If any criticism were to be suggested it might be directed toward a certain over-conservatism. Thus Castle concludes that mutation by variation in the number of chromosomes can not be a satisfactory general explanation of the origin of species. But neither can gene mutation, which he appears to regard as sufficient. He overlooks the large array of facts showing that in the species of a genus the chromosomes not infrequently differ by multiples of the smallest number in the genus. Also that the formation of tetraploids in mutations meet all the conditions for species formation; a new assemblage of several characters, more or less infertile with the parent species. A tenacity of views leads Castle to print for the third time (on page 43) his opinion that Darwin inherited a "good mind"—not a tendency toward natural history; this despite the great progress in the last few years in demonstrating the fundamental difference in special capacity (like music) of different strains of mankind.

The success of Castle's "Genetics" is largely due to his innate capacity for and experience in teaching. No doubt the need of putting things so that even immature college men can understand them has resulted in the marked clarity of the book. As a teacher he has seen the need of bringing the student into first-hand contact with the phenomena of genetics and so he has prepared an outline for a laboratory course in genetics. By use of the rapidly breeding banana fly and of dried ears of corn he has been able to bring students into contact with the methods and results of genetics within the span of a half year's course. This "outline" pamphlet includes valuable tables of deviation divided by probable error and the relative probability of occurrence of each genetic ratio; also of probable errors due to chance alone from various genetic ratios taken from Emerson. This "outline" will do much to put genetics on a proper pedagogic basis.

C. B. DAVENPORT
CARNEGIE INSTITUTION OF WASHINGTON,
COLD SPRING HARBOR, N. Y.

SEGREGATION OF CARBOHYDRATES IN MAIZE POLLEN

KIESSELBACH and Peterson[1] in two recent articles have attempted to disprove the results of previous investigators with respect to visible segregation in maize pollen and to the occurrence of more than ten haploid chromosomes in maize.

It is now generally accepted that the stored carbohydrate in the seeds of waxy maize stains red with iodine in sharp contrast with the violet reaction of the starch of non-waxy varieties, a condition first pointed out by Weatherwax and fully corroborated by other investigators. The waxy character behaves as a simple Mendelian unit recessive to the horny form, and back-crosses of heterozygous plants clearly show that one half of the pollen carries the gene for waxy and the other the gene for the horny allelomorph. Further, if pollen from F_1 plants is stained with a dilute solution of iodine, approximately half the grains give the characteristic violet color of starch, while the other half stain a reddish brown, a phenomenon clearly analogous to the distinction found in the seeds.

This differential staining of the pollen has been reported by Demerec,[2] Brink and MacGillivray,[3] and

[1] Kiesselbach, T. A., and Petersen, N. F., "The chromosome number of maize," *Genetics*, 10: pp. 80–85, 1925; "The occurrence of starch and erythrodextrin in maize and their segregation in the pollen of hybrids," *Genetics*, 10: pp. 86–89, 1925.

[2] Demerec, M., "A case of pollen dimorphism in maize," *Amer. Jour. Bot.*, 11: 461–464, 1924.

[3] Brink, R. A., and MacGillivray, J. H., "Segregation for the waxy character in maize pollen and differential development of the male gametophyte," *Amer. Jour. Bot.*, 11: 465–469, 1924.

Longley,[4] while Kiesselbach and Petersen have presented the sole dissenting view. They contend that the pollen of plants heterozygous for waxy endosperm can not be differentiated, by staining with iodine, from that of either homozygous form.

Any one who has seen a properly stained sample of pollen, heterozygous for Wx, will not doubt that the grains can be separated into two clearly marked classes.

The stage at which the two classes are most sharply separated is just before anthesis, but the distinction exists at all times when there are grains of carbohydrate stored in the pollen grain. Very old pollen has such a small amount of solid carbohydrate remaining that the classification of individual pollen grains may be difficult. But with flowers kept dry for over a year the pollen stained sufficiently satisfactorily to make certain the identification of horny, waxy and heterozygous individuals.

Practical use has been made of the differential staining of the carbohydrates in maize pollen which furnishes direct evidence of the reality of the distinction. The pollen from 200 plants grown from the horny seeds of an F_2 hybrid of waxy x horny was examined to detect those individuals heterozygous for Wx. This population, of course, was composed of both heterozygous and homozygous individuals and it was desired to confine hand pollinations to heterozygous plants. One hundred and thirty-three plants were found that produced two sorts of pollen when stained with iodine. These plants were all hand pollinated and without exception proved to be heterozygous for the waxy character, furnishing conclusive proof that the segregation had been recognized in the pollen. The sixty-seven plants classed as homozygous horny from the pollen examinations were discarded, but since this number corresponds very well with the expected one third there can be little doubt of the accuracy of the method. These results appear to provide a complete demonstration of the actuality of the observed differences in the pollen.

With respect to the chromosomes of maize Kuwada[5] alone has reported other than 10 as the haploid number. My early chromosome determinations as published[4] are in agreement with those of Kiesselbach and Petersen, but in the past season further studies have revealed that in four strains, two sweet and two starchy, other numbers occur. These are characterized by 21/2, 11, 23/2, 12 and even 13 haploid chromosomes at diakinesis, thus substantiating this phase of Kuwada's investigations.

[4] Longley, Albert E., "Chromosomes in maize and maize relatives," *Jour. Agric. Res.*, 28: 673–681, 1924.

[5] Kuwada, Y., "Die chromosomenzahl von *Zea Mays* L.," *Jour. Coll. Sci.* (Tokyo Imperial University), 39 (Article 10): 1–148, 1919.

Curiously enough, the plants with extra chromosomes were not visibly different from those having the customary number. One strain in which extra chromosomes were found had been self-fertilized for fourteen generations, but the plants of this progeny were not uniform with respect to chromosome number.

ALBERT E. LONGLEY
BUREAU OF PLANT INDUSTRY,
U. S. DEPARTMENT OF AGRICULTURE

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE USE OF BAKELITE IN THE PRESERVATION OF FOSSIL MATERIAL

IN considering some of the problems of the preservation of fossil material it occurred to the writer that Bakelite might be used in many cases in which shellac is unsatisfactory. In the course of the experiments the writer has been aided by Dr. Geo. W. Baekeland and the research staff of the Bakelite Corporation, both by advice and by the donation of material for use in the experiments. These courtesies are gratefully acknowledged.

Bakelite is superior for the purpose suggested because it is practically indestructible after hardening and because it is more elastic than shellac. The process of treatment is very simple; the varnish is thinned with the "thinner" furnished by the company, most successfully by a 50 per cent. addition, and the specimen after preliminary draining and drying is baked at a temperature of approximately 220° F. in an air bath for from ten to fifteen hours. Fortunately the temperature is not a critical but an approximate one and the air bath need not be closely watched. In the present experiments an electrically heated oven of good capacity was used. The Bakelite penetrates the material and leaves no accumulation upon the surface to obscure details; the color of specimens is slightly, but very slightly, darkened.

The first attempts were directed toward the preservation of very rotten and fragile specimens of Pleistocene and Recent bones, such as mastodon, buffalo and human bones. In this success was very apparent. In the most porous specimens the Bakelite was used without thinning and poured over the specimens, or the specimens immersed in the Bakelite, until they were thoroughly impregnated, then they were allowed to drain and dry for some hours, then heated for ten to fifteen hours at the proper temperature. It is necessary that the specimens, especially if of large size, be allowed to drain and dry before heating, as the varnish is apt to froth if heated before the thinner has evaporated. Also the specimen must be sponged with the thinner before baking to remove any varnish on

the outside, as it is insoluble after hardening. Experiments upon the most rotten and fragile specimens, with control experiments with shellac, showed decidedly superior results. The presence of the Bakelite presents no obstacle to fitting fragments or to cementing fragments together by the means ordinarily used. One instance will illustrate the success of the method. A human skull was selected that the writer could have crushed in his hands; after treatment it was dropped upon a table top, cautiously at first, and finally from a height of eighteen inches upon its vertex without injury.

In the course of the experiments it was ascertained that porous specimens which had been treated in the field with shellac would still take the Bakelite and could be much improved. Bakelite could be used in the field, but is not so easily kept or handled as shellac.

Attention was then turned to an attempt to treat fine-pored material, as porous bone and plaster of paris. As the problem was the same in both cases the experiments were carried out on a series of blocks of plaster of paris, approximately three by two by one inches. It was found that the fine-pored material absorbed the thinner and rejected the more viscous portion of the varnish. Attempts to overcome this were made in several ways:

(1) By prolonged soaking. No good results.

(2) By incorporating sand, sawdust and the like to increase the porosity. No good results.

(3) By preliminary heating and allowing to cool in the varnish. No good results.

(4) By change of viscosity by increased dilution. No good results.

(5) By partial submergence only. No good results.

More complicated methods, such as treating in vacuum and prolonged boiling in a reflux condenser, have not as yet been tried as the processes would by their increased complication defeat the end sought, that of finding an easily applied method for saving fragile material. Such methods might be usable in cases of especially valuable material.

It was suggested that the lack of hardening might be in part due to the fact that the high temperature had started the breaking down of the plaster. An impregnated block was heated for fifteen to sixteen hours in an atmosphere of steam. It showed a considerably higher degree of hardening. Upon reporting these results to Dr. Baekeland it was suggested by his research staff that a different type of varnish, No. 2C, might penetrate the porous material more readily. Blocks were soaked in this varnish for thirty-one hours and then baked for twenty-seven. It was found that the surface was hard but not the interior; they were rebaked for twenty-seven hours, and it was found that the interior was so hard that it could be only scratched with some difficulty with a knife.

The value of plaster casts is frequently impaired by the fact that they are painted to preserve them; this method permits their hardening so that they may be handled and even washed without injury, and still preserve all the finest details.

The main value of the process lies in the fact that the most fragile material, as the unique human remains, may be preserved in a practically indestructible medium. An attempt was made to use the Bakelite in the preservation of recent bones, such as cracking teeth and warping bones, but it was found that the necessary heating was harmful; on the other hand, specimens of this kind have been treated with the Bakelite and the heating omitted; already, after one week, the stickiness of the varnish has disappeared and the specimens seem to be well bound together. In the course of a few months they will be as hard as the baked specimens.

It is hoped that these experiments will suggest methods by which the most fragile material may be rendered practically indestructible.

E. C. CASE
UNIVERSITY OF MICHIGAN

SPECIAL ARTICLES

THE INOCULATION OF TOMATO AND TOBACCO PLANTS WITH POTATO MOSAIC VIRUS

THE appearance of mosaic disease in potato plants, under field conditions, is variable and indefinite, so that the question has been raised as to whether or not any potato plants are free from the disease and whether the signs are due to one or several diseases. Furthermore, while some investigators have been successful in transferring this affection in potatoes to tomato and tobacco plants, others have failed; so that at present there is a lack of uniformity of opinion concerning the relation of mosaic in potatoes to that in other species or genera of the *Solanaceae*. The characteristics of the disease in tobacco, however, are uniform and unmistakable. It seemed advisable, therefore, to determine whether or not the disease could be transferred from potato to tobacco and tomato, since, if the transfer could be made, it would be possible not only to test potato plants for mosaic but also to determine whether or not the irregular changes in the potatoes were due to several distinct diseases or were merely different manifestations of the same disease.

All the experiments were made with greenhouse plants at an optimum temperature of 28° to 30° C., except during one period, when, in combination with excessive dryness, a temperature of 20° to 22° C. prevailed. Then the tomato seedlings grew little, if any,

and the inoculated plants failed to show the disease—thus confirming the results of Johnson, Allard and others that active growths are essential for revealing the signs of natural or experimental mosaic.

Nine supposedly normal tobacco plants[1] were inoculated by rubbing two or three of the leaves of each with freshly cut mosaic potato tubers from three separate sources. After eight to fifteen days all but two of these nine tobacco plants exhibited the signs of typical mosaic disease, which can still be observed at present—over six months after inoculation. At the same time twenty-two tobacco plants similarly treated with non-mosaic materials, which were not derived from potato plants, remained normal.

The mosaic potato tubers were allowed to sprout and when the leaves showed the picture of the typical disease, some were removed and were rubbed into two to three leaves of each of eight supposedly normal tomato plants. After eleven days, all these latter exhibited typical mosaic.

In addition eighteen tobacco seedlings, in series of three, were inoculated in the same manner with six tubers from separate potato plants which showed very slight, if any, manifestations of mosaic. It is important to note that after as long a period as twenty-seven to thirty-seven days, from one to three of each series, or a total of thirteen, exhibited the typical picture of this affection. With the exception of the long incubation period the disease in these plants showed no difference from that derived from markedly involved potatoes. This production of mosaic in tobacco from supposedly normal potatoes has recently been reported by Johnson.

The active agent, whether originally derived from potatoes, tomatoes or tobacco, reacted similarly in centrifugalization tests. In dilutions in distilled water of 1:1,000 which had a specific gravity of 1.004, or of 1:5,000 with a specific gravity of 1.001, the supernatant fluid, after two hours' centrifugalization at 3,000 r. p. m., could induce mosaic disease in normal tobacco plants as quickly, actively and constantly as the sediment.

We may conclude that the disease in potato plants can be transferred to tomatoes and tobacco from either the leaf or tuber. The signs in tomatoes and tobacco are identical, whether the inoculum is derived from plants which showed very marked mosaic or from those which exhibited signs so slight as to be dubious—a fact which should be borne in mind in the selection of mosaic-free plants, since potato plants are always propagated from tubers. Furthermore, the appearance of the experimental disease is identical with the natural affection in tomatoes and tobacco.

PETER K. OLITSKY
JOHN H. NORTHROP

THE LABORATORIES OF
THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH,
NEW YORK

[1] We have found that the species *Nicotiana affinis* ("jasmine tobacco"), a horticultural variety of *Nicotiana alata* ("winged tobacco"), which was employed in these experiments together with the Connecticut broadleaf variety of tobacco, is as susceptible to the disease as the latter, but once the affection is established the signs are much more prominent—thus making it an ideal plant for these transfer experiments.

NOTES ON THE TOPOGRAPHY OF THE GOLGI APPARATUS IN GLAND CELLS

DURING the last year and a half I have been engaged in an intensive study of the Golgi apparatus in secretory cells, following up the recent researches of Nassonov and my subsequent suggestions as to the homology of the acrosome with recognized secretory granules. Over twenty kinds of gland cells have thus far been examined, most of which can be roughly grouped, on the basis of the appearance of their secretory granules, in one or another of the three usual types—mucous, serous or lipoidal (so-called modified sebaceous glands).

Cells which may be roughly classified as of the mucous type have been studied in the salivary gland of Limax, in the red portion of the Harderian gland of the rabbit, in the intestinal epithelium of the salamander, in the submaxillary and tear glands of the cat, and in the Harderian gland of the duck. In the invertebrate, Limax, the Golgi apparatus is always represented by a large number of discrete Golgi bodies, which are scattered throughout the cell but always peripheral to the increasing accumulations of secretory granules. In late stages they accordingly occupy a position on the periphery of a large mass of secretory products, which practically fills the whole cell. In all the vertebrate gland cells, on the other hand, the Golgi apparatus begins as a simple network, which gradually enlarges as secretion progresses, but always retains the condition of a much reticulated network. This network tends to occupy a position peripheral to the mass of secretory granules, which, on completion, are gradually pushed away from the Golgi area by their successors, and thus accumulate in peripheral spaces of the cell often quite distant from the Golgi apparatus.

Cells, to be roughly classified as of the serous type, have been studied in the salivary gland of Limax, in the pancreas of the salamander, and in the parotid, submaxillary and pancreas of the cat. Again in the invertebrate, Limax, the apparatus consists of scattered Golgi bodies, which are present in very large numbers and, as the secretory cycle progresses, be-

come scattered throughout the cell not only peripherally but especially among the secretory granules. In the vertebrates, there is the usual network, at first of simple type, later showing a progressive increase in complexity. But the most interesting feature in this type of cell is that the network gradually extends itself among the accumulating secretory granules, so that (with an exception of no importance here) it is brought into contact with many or all of the developing granules. The behavior of the Golgi apparatus thus enables one to distinguish a serous from a mucous cell by the mere difference in the relation set up between the granules and the Golgi network. It would appear that mucous granules are rapidly synthesized and separated from the Golgi area upon completion; while serous granules undergo a more gradual development (as shown indeed long ago by Altmann in the parotid, for example), the entire granular complement coming simultaneously to maturity at the end of a secretory cycle.

Cells producing lipoidal secretions have been studied in the oil glands of the chicken and duck, in the inguinal and Harderian (white portions) glands of the rabbit and in the Meibomian glands of the cat. The details differ somewhat in these different glands, but all agree in the fact that the Golgi apparatus, beginning as a more or less temporary polarized mass or network, is eventually disrupted and scattered as separate Golgi fragments or bodies throughout the cell. In some cases this is accompanied by a complete loss of cellular polarity, the nucleus moving into an indifferent central position. At the end of the secretory cycle, the entire cell is in all cases lost together with the secretory products. In the secretion thus produced, the Golgi pieces can in some cases (oil gland of duck and one part of the white portion of the rabbit's Harderian gland) actually be seen, still retaining, though outside of cellular boundaries, their identity and often their original intracellular shape—a striking demonstration of the real, material existence, often denied, of the Golgi apparatus.

In addition, the vas deferens and epididymis of the cat and rabbit and the liver of the cat have been examined, revealing networks of characteristic development and the usual polarity, but of types not readily classified in the groups indicated above.

These studies bring out in a surprising way the interdependence of the topography of the Golgi apparatus in a gland cell and the type of secretion being produced. In no case is this better demonstrated than in the submaxillary of the cat, where the demilune cells have been shown to possess a Golgi network obviously different from that in the mucous cells. This demonstrates beyond a doubt that these cells belong to different categories, and are in no way related to each other histologically—as many have supposed. Further, the topography of the Golgi apparatus in the demilunes indicates that they are cells of the serous type—a view reached on different grounds by other workers.

A detailed report of this work is now being prepared for publication.

ROBERT H. BOWEN

COLUMBIA UNIVERSITY

THE NATIONAL ACADEMY OF SCIENCES

ABSTRACTS OF PAPERS PRESENTED AT THE WASHINGTON MEETING, APRIL 25 AND 26

Deviation from the regular as an art principle: DR. C. E. SEASHORE and MILTON METFESSEL, State University of Iowa. This paper contains an exhibit of various renditions of the song "Annie Laurie" as transcribed by a photographic method. Records of this type permit us to express quantitatively and in fine detail the expression of artistic emotion in singing in terms of variations in pitch, time and intensity. Volume, timbre and other complex factors may also be determined by an extension of the same principle of measurement. One complete score of "Annie Laurie" as sung by Wells is exhibited with illustrative sections from twelve other singers in support of general principles discovered.

The rôle of mental measurement in the discovery and motivation of the gifted student: DR. CARL E. SEASHORE, University of Iowa. The paper discusses the scope and significance of measurements of first, magnitude; second, fixity; and third, intricacy in organization of varieties of individual differences; and illustrates this by new methods of procedure in the progressive selection and elimination of students at the college level. New aspects of three procedures are discussed, namely: first, diagnostic examinations in determining fitness for college work near the end of the high school course; second, placement examinations measuring, (a) training and (b) aptitude for each of the subjects open to freshmen; and third, a scientific approach to the building of the achievement examinations.

Biology and the principles of physics: PROFESSOR WOLFGANG KOHLER, University of Berlin. Wherever we find order in the processes of nature, we are inclined to assume that special arrangements bring about this order, compelling the forces of nature to work along certain lines with exclusion of others. Greek astronomy is an instance of this tendency. But in our times again, biology and psychology are used to explain the striking order in organic processes by the assumption of an extraordinary amount of special arrangements or machine-structures that are said to produce the observed order of functions. We have learned to regard our sun-system as a whole maintaining itself and its order by free intercourse of natural forces. But we generally forget

that perhaps much of the orderly functions and the self-maintaining reactions of organisms might be also the natural consequences of free intercourse of forces and processes in the whole of a living body. The processes and reactions in an inorganic system under given circumstances tend towards a certain equilibrium-order or distribution, and, before assuming that all the order and "fittedness" in organic processes is enforced by the constraints of special arrangements for all the special cases, we ought to examine how far that other kind of order, produced by relatively free interaction, may happen to occur in organisms and how far it may explain the striking features of organic life. Even in modern technics we find already some instances where the free tendency of systems towards an orderly equilibrium-distribution produces the same order that usually is enforced by clumsy machine-arrangements. And—surprising for many, not for the physicist—the order produced in the new way is more exact, is a better order than all the order artificially produced by means of machine-constraints. If we could give more attention to possibilities of this kind in organic life, some of the arguments of vitalism might perhaps lose their force.

Protoplasmic action of copper and gold: CARL VOEGTLIN, J. M. JOHNSON and HELEN A. DYER, Hygienic Laboratory, Washington, D. C. This work represents part of an investigation dealing with the toxic action of various heavy metal salts. These compounds are usually referred to as protoplasmic poisons, which means that in high dilution they exert a toxic action in all kinds of protoplasm. To illustrate, 1 part of copper in 100,000,000 parts of water will kill spirogyra in a few minutes. On account of this property the heavy metal salts are widely used as antiseptics, germicides and fungicides. The mechanism whereby these traces of heavy metal salts exert their toxic action is very little understood, and therefore, the main object of this work was to secure some information along this line. Most of the experiments were carried out with albino rats, but some work was also done with lower animals, for instance, tadpoles and plant cells (spirogyra). It was found that copper and gold salts can be detoxicated by the simultaneous injection of certain organic sulphur compounds containing a SH group. In the case of copper, glutathione and cystein are effective antidotes in rats. In the case of gold chloride, glutathione alone is effective. Similar observations were made on tadpoles and spirogyra. Inasmuch as some of these sulphur compounds are normal constituents of protoplasm this evidence suggests that copper and gold salts exert their toxic action through combining with these sulphur substances in the cells. In order to further support this hypothesis copper and gold derivatives of glutathione and cystein were actually prepared, thus showing that these heavy metal salts enter into chemical reaction with these substances.

Solubility of carbon dioxide in various organic solvents at low temperatures: FRANK PORTER. The solubility of carbon dioxide in sixteen organic liquids and in mixtures of these were investigated at −76.84 degrees centigrade. The effect of temperature on the solubility was also determined for acetone, ether and one of the mixtures. The solutions of carbon dioxide in ketones and esters of organic acids were found to approximate the ideal solution calculated from Raoult's law. Solutions in the hydrocarbons and sulfides show much greater deviations from the ideal solution at low temperatures than at room temperature. Neither the internal pressure nor the polarity as indicated by the dielectric constant serve as a satisfactory guide in predicting the solubilities of carbon dioxide. A similarity of structure is much more useful, the compounds containing the group $\overset{|}{\underset{|}{C}}=0$ being the best solvents.

The origin of terrestrial helium and its association with nitrogen and hydrogen: S. C. LIND, U. S. Bureau of Mines. Helium occurs in dilute concentration in the atmosphere and in rocks, radioactive minerals and waters of the earth's crust. In much greater concentration it occurs in certain natural gases associated principally with the lower paraffin hydrocarbons and nitrogen. Notwithstanding the increasingly larger quantities of helium found stored in natural gas pools, they do not exceed possible accumulation from radioactive processes extended over known geological time, without assuming improbable modes of collection.

The question has been raised as to how helium is liberated from minerals and rocks. The fact that a large proportion of it *is* liberated is borne out by the low He: Pb ratios found in the radioactive minerals. If all products of atomic disintegration retained *in loco*, lead and helium would accumulate in the ratio of 8 He: 1 Pb in uranium minerals, and 6 He: 1 Pb in thorium minerals. In reality only one third to one sixth or less of the theoretical helium is retained, which may be regarded as direct proof of leakage, either into gas structures or into the atmosphere.

The evolution of helium from minerals or rocks may be promoted by the "sweeping" action of other gases generated *in loco* by the action of the initial particles on compounds capable of being decomposed to form gases such as nitrogen, hydrogen or carbon dioxide. The ratio of He to foreign gases might vary over a wide range, depending on the proportion of material in the structure capable of decomposition. The fact that the He: N_2 ratio is much higher within radioactive minerals than in natural gases indicates that adsorption is not responsible for their presence in the mineral, but rather the reverse, evolution from the mineral and later further dilution with extraneous sweeping gases. The possible genetic origin of nitrogen from uranium is discussed.

The foundations of electric circuit theory: J. R. CARSON. Electric circuit theory is that branch of general electrical theory which deals with electrical oscillations in electrical circuits and networks: more precisely stated, with the distributions of currents and charges in the free oscillations of the network or under the action of impressed forces.

The enormous importance of electric circuit theory in electrotechnics does not require emphasis: it is funda-

mental to the engineering theory of transmission and to the design of all terminal apparatus as well as transmission lines.

Historically, the development of electric circuit theory preceded that of electromagnetic theory in the hands of Maxwell and later of Lorentz. In fact, circuit theory is based entirely on the simple laws of Faraday and Kirchhoff. It is true that Maxwell developed a dynamical theory of electric circuits, but this amounts to little more than a more elegant way of deriving the equations of circuit theory and is based on the same assumptions and subject to the same restrictions as is the Faraday-Kirchhoff theory.

The object of this paper is to examine the foundation of electric circuit theory from the fundamental equations of electromagnetic theory. This will involve a derivation of the laws of electric circuit theory directly from the electromagnetic equations in the course of which the assumptions, approximations and restrictions of circuit theory will be explicitly stated.

Such an analysis is believed to be both desirable and necessary. In the first place, circuit theory, by reason of its early development, is based on a philosophy which for the most part is quite foreign, and in its implications often contradictory to the underlying concepts of electromagnetic theory. This is evidenced by the complete divorce, in treatises on electromagnetic theory, such as that of Jeans, between the chapters on general theory and those dealing with the theory of currents in linear networks. In fact, in no treatise known to the writer is there any attempt to bridge the gap or to bring circuit theory within the scope of electromagnetic theory in a satisfactory manner. Furthermore, as circuit theory is usually taught to technical students, a general picture of electromagnetic theory is not given, and the student comes to regard inductance, resistance, capacity, voltage, etc., as fundamental concepts.

A second consideration is believed also to justify the present study: This is the fact that in the course of technical development an increasing number of problems is being encountered, which lie quite outside the scope of circuit theory, or in which the conclusions derived from circuit theory must be interpreted with great care.

This situation may be illustrated by an analogy from mechanics. Suppose that the laws and theory of rigid mechanics were accepted as fundamental and that the elastic properties of the mechanical constraints were ignored. It is obvious that, while little error would follow in a large class of problems, a whole range of phenomena would lie completely outside the scope of mechanics. This analogy is more than a superficial illustration because the dynamic theory of electric circuits is precisely the same as that of rigid mechanics and its limitations of precisely the same character.

The odorous constituents of the cotton plant; emanation of ammonia and trimethylamine from the living plant: FREDERICK B. POWER and VICTOR K. CHESNUT, Bureau of Chemistry, U. S. Department of Agriculture. It has been recognized that the cotton plant possesses a specific attraction for the boll weevil, and this has been attributed to some volatile odorous substance emitted by the plant which could be perceived by the insects at a considerable distance. It has accordingly been considered by Dr. L. O. Howard, chief of the Bureau of Entomology, U. S. Department of Agriculture, that if any odorous substance could be identified, which by chemotropic tests would be found attractive for the insects, it might be possible to produce it in sufficient quantities to permit of its use as a bait.

In pursuance of the above-mentioned plan the Bureau of Chemistry was requested to undertake a comprehensive study of the subject, and the investigation was begun in the summer of 1923. As the primary purpose was to ascertain the chemical character of the odorous or volatile substances, it was apparent that these could best be obtained by the distillation of the cotton plant with the aid of steam. This operation was conducted during the months of July and August at Tallulah, Louisiana, where all the facilities of the Delta Laboratory of the Bureau of Entomology were generously placed at our disposal.

A field of choice Upland cotton, comprising about ten acres, had been selected for our use, and this was comparatively free from infestation with weevils. The plants were cut off a few inches above the ground, and the material employed consisted chiefly of the foliage, together with the flowers, squares and a few small bolls, the coarse woody stems having been rejected. Not more than about two hours elapsed between the cutting of the plant in the field and the beginning of distillation. The total amount of material distilled was 7,255 pounds or 3,290 kilograms and the total original distillate amounted to about 1,400 gallons or 5,300 liters.

The next step in the process was to concentrate the original distillate in order that the odorous constituents might be contained in a smaller volume, and this was accomplished by its redistillation from a smaller apparatus. The complete examination of this concentrated distillate, which amounted to 78 gallons or 295 liters, was conducted in the laboratory of the Bureau of Chemistry.

The so-called *essential oil* of the plant was obtained by extracting a portion of the concentrated distillate with ether, and the yield of this product was about 0.003 per cent. of the material employed. It was a pale brownish-yellow, limpid liquid, having a strong, rather agreeable and persistent odor.

The concentrated distillate, which represented all the odorous and volatile constituents of the plant, was the product employed for their separation and identification. It was found to contain the following individual substances: (1) Methyl alcohol, in large amount, and traces of acetone; (2) amyl alcohol, in relatively small amount, together with small amounts of higher homologues; (3) acetaldehyde, and traces of an aldehyde of higher carbon content; (4) vanillin, $C_8H_8O_3$, in very small amount; (5) a phenol, in exceedingly minute amount. This substance is either a derivative of *m*-cresol or a phenol that possesses very similar characters; (6) an optically inactive, dicyclic Sesquiterpene, $C_{15}H_{24}$; (7) a new, optically active, tricyclic Sesquiterpene, $C_{15}H_{24}$; (8) a small amount of a paraffin hydrocarbon, m. p. 62°, which apparently is

triacontane, $C_{30}H_{62}$; (9) a blue oil, which probably contains the highly unsaturated hydrocarbon, azulene, $C_{15}H_{18}$; (10) formic, acetic and caproic acids, the latter in small proportion, which probably were present to some extent in combination with the previously mentioned alcohols as esters; (11) ammonia; (12) trimethylamine.

The two last-mentioned basic substances were present in appreciable amounts in the distillate, but the ammonia largely predominated. Both ammonia and trimethylamine were also found to be emanations from the living plant, and they have been identified in the dew collected from the foliage. It has been recorded that so small an amount of trimethylamine as 0.0000005 gram can be distinctly detected by its odor.

The more complete details of this investigation must necessarily be reserved for a future publication.

Report on southern nebulae: DR. HARLOW SHAPLEY, Harvard Observatory. (1) The absolute magnitudes and linear dimensions of a large number of diffuse nebulae have been measured recently in the course of studies on the star clouds of Magellan. These extensive star systems are themselves now taken as representative of a large class of non-galactic nebulae. They are, in a sense, the nearest of the spiral nebulae, and being only one hundred thousand light years distant are most suitable for detailed analysis of structure and content.

(2) Recent photometric measures have shown that the absolute magnitudes of the diffuse nebulae and nebulous clusters are approximately −5. Their diameters range from five to twenty light years.

(3) The greatest diffuse nebula now known is 30 Doradus, the Looped Nebula in the Large Magellanic Cloud, for which the diameter is nearly five hundred light years and the absolute brightness about −14.

(4) The spiral Messier 33 compares closely with the Large Magellanic Cloud in linear dimensions and integrated absolute brightness, but it is nearly nine times as far away. The nuclei in the arms of the spiral are of about the same brightness and dimensions as the gaseous nebulae and smaller nebulous clusters in the Magellanic Clouds.

(5) In the investigation of faint southern nebulae of the spiral family, several thousand new objects have been catalogued at the Harvard Observatory. A statistical examination of this material shows that the spheroidal subclass furnishes four fifths of the nebulae that lie outside the Milky Way.

(6) As a contribution to the problem of nebular distribution and form, the whole southern sky is being systematically covered with long exposure photographs, made with the Bruce telescope at Arequipa, Peru. The program is considerably more than half completed.

Measurements of the variation: DR. C. G. ABBOT, Smithsonian Institution. Mr. Clayton, who is about to address you, will present evidence that the variation of the sun is of importance for weather forecasting. It is for me to try to show you just what he means by the variations of the sun, and why he believes that it is a reality.

For over twenty years, the Smithsonian Institution has been carrying on measurements of the solar constant. We have operated at eight different observatories at various levels and under a great range of atmospheric conditions. We have invented improved apparatus and processes for applying Langley's method of high and low sun spectroscopy. About six years ago we devised another very brief empirical method based upon it. By our new method it is possible for two observers to make and reduce five independent determinations of the solar constant in a working day. The new method also avoids errors from changes of atmospheric transparency during the interval of several hours between high and low sun.

For the past five years, we have maintained two observatories for this work. One is on a desolate mountain in central Arizona, called Mt. Harqua Hala. The other is on a completely barren mountain in northern Chile, where no living thing grows or moves. We receive daily telegraphic reports from both stations, and we make up from them daily morning telegrams to Mr. Clayton, giving him the solar constant value of the morning next preceding. This is the information on which his recent results are based.

Figure 1 shows the run of ten-day mean solar constant values from 1920 to 1924. You will perceive two different levels for the years 1920–21 and 1923–24, respectively. The year 1922 is a transition year. The two levels are nearly 3 per cent. apart and indicate prevailingly low values in more recent times. The mean of our entire series of nearly twenty years of observation has not been reached by more than a half dozen ten-day mean values for nearly three years.

Can we believe this? Does the sun really vary in this way? Figure 2 shows a comparison between sun-spot numbers and our solar constant values for twenty years. Evidently, according to past experience, we are to expect lower values at a period of sun-spot minimum such as has prevailed from 1922 to 1925.

But there is a more minute type of solar change revealed by our results. They show that irregular variations of one or more per cent. occur in the output of solar radiation in short periods of a few days. These changes are supported by the combined testimony of our two observatories. They seem to be associated with visible features upon the sun, such as sunspots and faculae. In other words, though presence of very numerous sunspots betokens high solar radiation, yet whenever one of them marches across the center of the sun's disk there is a brief interval of diminished solar radiation. It appears as if a solar cloud overshadows each sunspot, which, when it comes squarely between the earth and the sun, produces a small depression of radiation.

Without distinguishing between the two types of solar variation, I have sought to localize it in the spectrum, or in other words to see if all parts of the spectrum share it equally. Figure 6 shows that, far from this being the case, solar variation is almost wholly confined to wavelengths less than 0.5 microns, that is to the blue, the violet and the ultra-violet spectrum.

Mr. Clayton will tell you still more of interest relating to the solar variation. He will show that he is even able

to predict it five days in advance, with considerable success, from visual observations of the sun's surface. I leave the matter now in his hands, confident that I have presented enough to lead you to believe that the solar changes which he is connecting with weather and climate are real.

The dependence of the earth's weather on variations of the sun: H. H. CLAYTON, Canton, Mass. The investigations of Langley, followed by the persistent researches and efforts of Abbot and his colleagues, have demonstrated that our sun, like so many of the stars in space, is a variable. Its radiation of light and heat varies from day to day, from month to month, and from year to year. The change when measured in percentages of the total radiation is small, but is measurable by the delicate apparatus of modern science. "It was found that with every class of variation of solar radiation, whether of a few days', a few months,' or many years' duration, as in the sunspot period, the normal areas of high and low pressure in the earth's atmosphere swing north and south in unison with the changes in solar radiation, and thus determine excesses or defects of temperature and rainfall which swing north and south with the pressure, the effects increasing in intensity with increasing latitude," said Dr. Clayton. "In the northern United States and Canada these changes may amount to as much as 40 degrees Fahrenheit with a departure of only one per cent. of solar radiation on either side of the normal, and the rainfall may change from double the normal amount to less than half normal, which if long continued becomes a severe drought. In winter the excess of pressure is over the continents and in summer over the oceans.

"It was already known from Dr. Abbot's work that the amount of heat radiation from the sun varies with the number of sunspots in the eleven-year sunspot period, being greatest at maximum sunspots. Further research discloses that the day to day variations of solar radiation are closely related to the position of sunspots and faculae on the face of the sun as seen from the earth. When the spots and faculae are on the central meridian of the sun, there is a diminution of solar radiation, probably resulting from absorption, and an increase above normal when the spots and faculae are on the edges of the sun. The side of the sun on which the spot is located averages cooler than the opposite side, and there appear to be periodic oscillations of about 3½, 7 and 14 days, which are in some way related to solar conditions.

"When the meteorological data in the United States are compared with the pressure and temperature in the United States, the same relations are found as would be expected from the correlated changes in solar radiation. The passage of spots across the central meridian of the sun is immediately followed by low pressure at central continental stations like Winnipeg, and higher pressure is found at the same stations on the average when the spots and faculae are on the eastern and western limbs of the sun.

"The relation to the temperature is opposite to that of the pressure. When studied separately for the four seasons, winter, spring, summer and autumn, similar relations to the position of the spots and faculae are found for each season, but the effect is delayed about one day in spring and autumn, and two days in summer, as compared with winter. The high correlation of the separate independent relations with each other is a further proof of the reality of the relations.

"It is thus evident by several different lines of research that there is an intimate relation between solar changes and weather, and the results promise to revolutionize the art of weather forecasting. Already the Argentine Weather Service is practically applying the observations of solar radiation and visual observations of the sun to forecasting, and has established a solar observatory for independent research. That other national weather services will follow in the near future is certain."

Evidences of recurrent glaciation in the Sierra Nevada of California: F. E. MATTHES, U. S. Geological Survey. The glacial history of the Sierra Nevada has been a subject of popular as well as scientific interest ever since the early seventies of the last century, when John Muir and Professor Josiah D. Whitney engaged in their historic controversy over the origin of the Yosemite Valley. Yet it is only since 1913 that any really definite information has been at hand concerning the extent of the main glaciers on the west flank of the range, nor of the history of their successive advances. In that year a systematic and detailed survey of the moraines and other glacial features of the Yosemite region permitted for the first time a definition of the exact extent reached by the ancient Yosemite Glacier in each of two distinct glacial stages. Supplementary studies of a similar nature have since been carried on in the basins of the Stanislaus, Tuolumne, Merced and San Joaquin rivers. The results may be summarized as follows:

(1) There are on the west flank of the range two distinct series of moraines, an older and a younger, that record two stages of glaciation divided by a lengthy interval of essentially nonglacial conditions. The older series itself probably will prove upon further study to embody a multiple record.

(2) The last stage of glaciation is comparable in point of recency to the Wisconsin stage of the continental ice sheet. The earlier stage or stages remain as yet uncorrelated.

(3) That the two great ice extensions recorded in the moraines took place in two distinct glacial stages and were not mere fluctuations in an otherwise continuous cycle of glaciation is abundantly attested by:

(a) The marked contrast in the degree of preservation of the two moraine series, the younger being conspicuous for its fresh, sharp-crested forms and unweathered boulders; the older being dimmed and in part destroyed by disintegration and erosion, and composed of boulders so badly decayed that many are readily trenched with a pick;

(b) The equally marked contrast in the aspect of the rock floors that were covered by the earlier and later glaciers, respectively, the latter still retaining polish and

striae over large areas, the former being eroded into irregular forms and having completely lost their glacial facies;

(c) The considerable depth of stream erosion accomplished since the deposition of the older drift, as compared with the insignificant depth of the postglacial stream erosion; the ratio being approximately 10 to 1.

(4) The remoteness of the earlier glaciation, further, is strikingly attested by the fact that some boulders of the earlier drift are perched on rock pedestals several feet in height; also by the presence of residual rock forms that stand five to fifteen feet high above the old glaciated rock surfaces.

Most clean-cut and instructive are the residual rock features situated north of the Little Yosemite Valley, on the summit of Moraine Dome, which locality may be said, indeed, to hold the key to the glacial history of the Sierra Nevada. They resemble little garden walls, and are formed by dikes of aplite that disintegrate with extreme slowness as compared with the surrounding granite. Their height—seven to ten feet—affords a minimum measure of the stripping which the dome has suffered since the departure of the earlier ice, and permits an estimate to be made of the time that has since elapsed. As the same granite on the lower slopes of the dome still retains the polish of the last glaciation, which is conservatively estimated to be 10,000 to 15,000 years old, the stripping indicated by the aplite walls on the summit would indicate a lapse of time expressible in terms of hundreds of thousands of years.

(5) Systematic mapping of the two moraine series shows that the earlier glaciation was much the more extensive of the two. The earlier glaciers attained lengths of over sixty miles—they were the largest glaciers that existed in southern latitudes in the United States, and together formed a continuous system that far exceeded in extent any similar glacier system in the southern Rocky Mountains. It is clear, moreover, that the bulk of the glacial excavating in the Yosemite Valley, as well as in the other Sierra canyons, was performed by the earlier glaciers.

(6) At no time was the Sierra Nevada completely domed over; its highest peaks and crests always stood well above the ice. Neither did the glacial mantle extend more than half way down the west flank. Even the trunk glaciers did not reach within thirty miles of the foothills, and the intercanyon divides remained uncovered up to altitudes ranging from 5,000 to 7,000 feet.

(7) The variations in the extent of the glacial mantle of the Sierra Nevada, from north to south, reflect the intercepting effect of different parts of the Coast Ranges on the water vapor borne landward by the winds from the Pacific Ocean. Within certain geographic limits this intercepting effect was a stronger factor in determining the distribution of the ice on the Sierra Nevada than either latitude or altitude.

(8) The ice lines of the two glacial stages, though 3,000 feet apart in altitude in the Yosemite region, rapidly approach each other in the High Sierra and practically coincide in the summit cirques. These cirques, which were the ultimate sources of the glaciers, evidently were filled to no greater depth in the earlier than in the later glaciation. This circumstance, taken together with the fact that the lowest level of glacier generation was about the same in either stage, would show that the climatic conditions in the two glacial stages were closely similar. The greater extent and volume of the earlier glaciers is to be attributed, therefore, largely to the greater duration of the period of snow accumulation in the earlier stage.

Report of ether drift experiments: DR. DAYTON C. MILLER, Case School of Applied Science, Cleveland, Ohio. Observations on the Michelson-Morley ether drift experiment have been continued at Cleveland in 1923 and 1924, and at Mount Wilson in 1924 and 1925. The Mount Wilson observations consistently give results indicating a small positive effect. The final interpretation will depend upon observations to be made later in this year.

Distribution of the stars with respect to brightness and distance from the milky way: DR. FREDERICK H. SEARES, Mt. Wilson Observatory, and P. J. VAN RHIJN, Kapteyn Astronomical Laboratory, Groningen, Holland. A new determination of the numbers of stars of different degrees of brightness within the reach of large telescopes and their distribution over the sky is the culmination of several years work by Frederick H. Seares, of the Mount Wilson Observatory, and P. J. van Rhijn, of the Kapteyn Astronomical Laboratory at Groningen, Holland. The results show that in the whole sky at least a billion stars could be photographed with the 100-inch reflector of the Mount Wilson Observatory, and that from 20 to 40 times as many more stars are too faint to be directly observed.

It has long been known that the stars form a system, filling a flattened, watch-shaped region of space, with the Milky Way lying in the central plane of the "watch." It is also known that the stars thin out in passing from the sun, which is not far from the center of the system, to regions more and more remote.

The stars whose distances can be directly measured are all so near that they do not determine the structural features of the system, which must be learned from star counts, such as those just completed, whose numerical values reflect the way in which stars are scattered through space. Were the stars all equally luminous, the obvious differences in brightness noted by the eye would be merely the effect of differences in distance, which could easily be calculated. Actually, the range in stellar luminosity is enormous; this complicates the problem, but the structure of the system can still be determined from star counts, provided the numbers of stars of different luminosity in a given region of space can be found. The way in which luminosity is apportioned among the stars is at present imperfectly known, although well enough defined for provisional use of the counts.